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Factors Associated with Difficult Laparoscopic Cholecystectomy Among Patients with Gallstone Disease

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ABSTRACT

Background: *Laparoscopic cholecystectomy is the treatment of choice for gallstone disease, which is one of the most common surgical problems. However, some cases can be complicated by inflammation, adhesions, a thickened gallbladder wall, or impacted stones.* ***Aim of the study:*** *This study was designed to find the factors associated with difficult laparoscopic cholecystectomy in patients undergoing cholecystectomy for gallstone disease.* ***Methods & Materials:*** *This retrospective observational study included 360 symptomatic gallstone patients aged ≥18 years who underwent elective or emergency laparoscopic cholecystectomy at CMH Savar, Dhaka, Bangladesh, between May 2024 and May 2026. Difficult laparoscopic cholecystectomy was defined by prolonged operative time, challenging Calot's triangle dissection, dense adhesions, significant bleeding, gallbladder perforation with spillage, drain placement, or conversion to open surgery. Independent predictors were identified using logistic regression in SPSS version 26.* ***Results:*** *Among 360 patients, the mean age was 46.2 ± 13.4 years, and females were predominant (232; 64.4%). Overweight or obesity was present in 221 (61.4%). Difficult laparoscopic cholecystectomy was observed in 110 (30.6%) cases. Difficult LC was significantly associated with age >50 years, male sex, BMI ≥25 kg/m², symptoms >72 hours, previous acute cholecystitis, diabetes mellitus, raised leukocyte count, thickened or contracted gallbladder, pericholecystic fluid, impacted stone, multiple stones, and dilated common bile duct. Independent predictors were pericholecystic fluid (AOR 3.78); thickened gallbladder wall (AOR 3.25); previous acute cholecystitis (AOR 3.10); impacted stone (AOR 2.96); and symptoms >72 hours (AOR 2.72).* ***Conclusion:*** *Difficult laparoscopic cholecystectomy was common among patients with gallstone disease and was mainly predicted by prolonged symptoms, previous acute cholecystitis, raised leukocyte count, thickened gallbladder wall, pericholecystic fluid, and impacted stone. Careful preoperative assessment may help identify high-risk patients and improve surgical planning and safety.*

Keywords: *Gallstone disease; Difficult laparoscopic cholecystectomy; Acute cholecystitis; Gallbladder wall thickness; Pericholecystic fluid.*

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INTRODUCTION

Gallstones are one of the most prevalent benign biliary diseases and are still a significant cause of surgical admission the world over. The surgical removal of the gallbladder (cholecystectomy) is the most effective treatment for symptomatic gallstones and is now the preferred procedure as it results in less pain, brief hospital stays, and improved recovery and cosmetic appearance when compared to open cholecystectomy [1]. But not all cholecystectomies are performed laparoscopically without problems. For a portion of patients, the procedure is difficult due to dense adhesions, distorted Calot's triangle, thickened/grossed up gall bladder, impacted stone, inflammation (acute/chronic), bleeding, and exposure problems [2]. Clinically, difficult laparoscopic cholecystectomy is important as it leads to longer operating time, gallbladder perforation, bile and stone spillage, blood loss, bile duct injury, utilization of drains, increased morbidity, hospital stays, and conversion to open operation [3]. Gallstone disease is a significant worldwide problem. Worldwide prevalence of gallstones has been estimated to be between 5 and 7% based on previous systematic reviews and appears to be significantly greater in women, the elderly, and people with metabolic risk factors [4,5]. Urbanization, dietary changes, obesity, diabetes, sedentary lifestyle, and increased availability of abdominal ultrasonography are important factors in the rising prevalence of gallstone disease in many LMICs [5,6]. Gallstone disease is one of the common factors that are seen in surgical admissions (both elective and emergency cases) in South Asian countries like Bangladesh. It has been noted that in Bangladesh, symptomatic cholelithiasis and acute cholecystitis are the common indications for laparoscopic cholecystectomy, and the proportion of patients operated on had significantly higher cases of diabetes and hypertension, with females affected more [7,8]. Predicting the likelihood of difficulty during the laparoscopic procedure is crucial for surgical planning and safe surgery. Multiple laboratories, clinical, and ultrasonographic parameters have been reported to predict difficulty during operation. Some factors were associated with difficult dissection and conversion risk, including older age, male sex, obesity, history

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of acute cholecystitis, prolonged symptoms, previous hospitalization, an elevated leukocytosis, elevation of inflammatory markers, a thickened gallbladder wall, a contracted gallbladder, pericholecystic fluid, an impacted stone at the neck or at Hartmann's pouch, and a dilated common bile duct [2,3,9]. Its advantages include being widely available, not requiring an invasive procedure, not being expensive, and being routinely ordered prior to cholecystectomy. Gallbladder thickening, impacted stone, pericholecystic collection, and contracted gallbladder indicate to the surgeon that it may be difficult to dissect the Calot's triangle [10]. Despite the availability of international evidence, local prediction remains important because patient characteristics, disease presentation, timing of hospital attendance, surgical expertise, and resource availability differ across settings. In Bangladesh, many patients present with recurrent biliary colic or delayed-stage acute inflammation, which may increase operative difficulty. However, published local data on combined clinical, biochemical, and sonographic predictors of difficult laparoscopic cholecystectomy are still limited. Most available studies focus on operative outcomes or complications rather than systematically identifying preoperative factors associated with difficulty [11,12]. Therefore, locally generated evidence is needed to improve patient counseling, operative scheduling, senior surgeon involvement, perioperative preparedness, and timely decision-making regarding conversion. Therefore, this study was conducted to identify the factors associated with difficult laparoscopic cholecystectomy among patients with gallstone disease.

METHODS & MATERIALS

This hospital-based retrospective observational study was conducted in the Department of Surgery at the Combined Military Hospital, Savar, Dhaka, Bangladesh. The study included hospital records of patients with gallstone disease who underwent laparoscopic cholecystectomy over a two-year period, from May 2024 to May 2026. A total of 360 eligible patients were selected by consecutive sampling after applying the inclusion and exclusion criteria. Patients aged 18 years or above with symptomatic gallstone disease who underwent elective or emergency laparoscopic cholecystectomy were included. Patients with suspected gallbladder malignancy, choledocholithiasis requiring prior biliary intervention, severe cardiopulmonary disease unfit for laparoscopy, previous upper abdominal surgery with dense adhesions, pregnancy, and incomplete medical records were excluded. Data were extracted retrospectively from hospital records using a pre-designed structured data collection sheet. Socio-demographic variables included age, sex, residence, and body mass index. Clinical variables included presenting symptoms, duration of symptoms, recurrent biliary colic, previous attack of acute cholecystitis, fever, jaundice, diabetes mellitus, hypertension, ischemic heart disease, and other comorbidities. Laboratory parameters included total leukocyte count and serum bilirubin. Ultrasonographic findings included gallbladder wall thickness, gallbladder status, number of stones, pericholecystic fluid, impacted stone at the neck or Hartmann's pouch, and common bile duct diameter. Intraoperative findings were collected from operation notes, including adhesions around the gallbladder, gallbladder wall condition, difficulty in Calot's triangle issection, gallbladder perforation, bile or stone spillage, bleeding, drain placement, operative time, and conversion to open surgery. Laparoscopic cholecystectomy was categorized as difficult when one or more of the following were recorded: prolonged operative time, difficult Calot's triangle dissection, dense adhesions, significant bleeding, gallbladder perforation with spillage, need for drain placement, or conversion to open surgery [13-15]. Data were checked, coded, and analyzed using SPSS version 26. Quantitative variables were presented as mean ± SD, and qualitative variables were presented as frequencies and percentages. Comparisons between categorical variables were made using the chi-square test or Fisher's exact test, and comparisons between continuous variables were made using the independent-samples t-test. Variables showing significant association in bivariate analysis were entered into multivariate logistic regression to identify independent predictors of difficult laparoscopic cholecystectomy. A p-value <0.05 was considered statistically significant.

RESULTS

Among 360 patients, the mean age was 46.2 ± 13.4 years. The highest proportion was in the 31–40 years age group (96; 26.7%), followed by the 41–50 years age group (92; 25.6%). Female patients were predominant (232; 64.4%). Most patients were from urban areas (206; 57.2%). Overweight or obesity was present in 221 patients (61.4%) (*Table I*).

Table I: Baseline Characteristics of the Study Patients (*n* = 360)

Variables	Frequency (n)	Percentage (%)
Age group (years)		
≤30	44	12.2
31–40	96	26.7
41–50	92	25.6
51–60	78	21.7
>60	50	13.9
Mean ± SD	46.2 ± 13.4	
Sex		
Male	128	35.6
Female	232	64.4
Residence		
Urban	206	57.2
Rural	154	42.8
BMI category		
Normal weight	139	38.6
Overweight/obese	221	61.4

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Right upper abdominal pain was the most common symptom (344; 95.6%), followed by nausea/vomiting (230; 63.9%). Recurrent biliary colic was found in 218 (60.6%) of patients, while previous acute cholecystitis was present in 103 (28.6%). A raised total leukocyte count was observed in 112 (31.1%). On ultrasonography, gallbladder wall thickness >3 mm was found in 147 (40.8%), multiple gallstones in 236 (65.6%), and an impacted stone at the neck/Hartmann's pouch in 101 (28.1%) patients (*Table II*).

Table II: Clinical, Laboratory, and Ultrasonographic Findings (*n* = 360)

Variables	Frequency (n)	Percentage (%)
Right upper abdominal pain	344	95.6
Nausea/vomiting	230	63.9
Fever	96	26.7
Symptoms >72 hours	147	40.8
Recurrent biliary colic	218	60.6
Previous acute cholecystitis	103	28.6
Diabetes mellitus	74	20.6
Hypertension	86	23.9
Raised total leukocyte count	112	31.1
Raised serum bilirubin	38	10.6
Gallbladder wall thickness >3 mm	147	40.8
Contracted gallbladder	93	25.8
Pericholecystic fluid	80	22.2
Impacted stone at neck/Hartmann's pouch	101	28.1
Multiple gallstones	236	65.6
Dilated common bile duct	32	8.9

Table III shows the distribution of patients according to operative difficulty. Easy laparoscopic cholecystectomy was performed in 250 patients (69.4%), while difficult laparoscopic cholecystectomy was observed in 110 patients (30.6%).

Table III: Distribution of Patients According to Difficulty of Laparoscopic Cholecystectomy

Difficulty status	Frequency (n)	Percentage (%)
Easy laparoscopic cholecystectomy	250	69.4
Difficult laparoscopic cholecystectomy	110	30.6
Total	360	100

Difficult LC was significantly more common among patients aged >50 years (56; 50.9%), males (50; 45.5%), and those with BMI ≥25 kg/m^2 (83; 75.5%). It was also significantly associated with symptoms >72 hours (71; 64.5%), previous acute cholecystitis (57; 51.8%), diabetes mellitus (33; 30.0%), and a raised total leukocyte count (62; 56.4%) (*Table IV*).

Table IV: Factors Associated with Difficult Laparoscopic Cholecystectomy

Variables	Easy LC (n = 250)	Difficult LC (n = 110)	p-value
	n (%)	n (%)	
Age >50 years	72 (28.8)	56 (50.9)	<0.001
Male sex	78 (31.2)	50 (45.5)	0.013
BMI ≥25 kg/m^2	138 (55.2)	83 (75.5)	<0.001
Rural residence	96 (38.4)	58 (52.7)	0.016
Symptoms >72 hours	76 (30.4)	71 (64.5)	<0.001
Previous acute cholecystitis	46 (18.4)	57 (51.8)	<0.001
Diabetes mellitus	41 (16.4)	33 (30.0)	0.005
Raised total leukocyte count	50 (20.0)	62 (56.4)	<0.001

Gallbladder wall thickness >3 mm was found in 76 (69.1%) difficult cases, compared with 71 (28.4%) easy cases. Difficult LC was also significantly associated with contracted gallbladder (49; 44.5%); pericholecystic fluid (49; 44.5%); impacted stone at neck/Hartmann's pouch (56; 50.9%); multiple gallstones (81; 73.6%); and dilated common bile duct (16; 14.5%) (*Table V*).

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Table V: Ultrasonographic Predictors of Difficult Laparoscopic Cholecystectomy

Variables	Easy LC (n = 250) n (%)	Difficult LC (n = 110) n (%)	p-value
Gallbladder wall thickness >3 mm	71 (28.4)	76 (69.1)	<0.001
Contracted gallbladder	44 (17.6)	49 (44.5)	<0.001
Pericholecystic fluid	31 (12.4)	49 (44.5)	<0.001
Impacted stone at neck/Hartmann's pouch	45 (18.0)	56 (50.9)	<0.001
Multiple gallstones	155 (62.0)	81 (73.6)	0.043
Dilated common bile duct	16 (6.4)	16 (14.5)	0.021

The mean operative time was significantly longer in difficult LC than in easy LC (93.5 ± 28.7 versus 54.6 ± 14.8 minutes). Difficult LC was associated with higher rates of gallbladder perforation (43; 39.1%), bile/stone spillage (51; 46.4%), significant bleeding (37; 33.6%), conversion to open surgery (20; 18.2%), and drain placement (42; 38.2%). Mean hospital stay was also longer in difficult LC (3.6 ± 1.4 days), compared with 1.8 ± 0.7 days in easy LC (*Table VI*).

Table VI: Operative Outcomes and Independent Predictors of Difficult LC

Variables	Easy LC (n = 250) n (%)	Difficult LC (n = 110) n (%)	p-value
Mean operative time (minutes)	54.6 ± 14.8	93.5 ± 28.7	<0.001
Gallbladder perforation	28 (11.2)	43 (39.1)	<0.001
Bile/stone spillage	41 (16.4)	51 (46.4)	<0.001
Significant bleeding	16 (6.4)	37 (33.6)	<0.001
Conversion to open surgery	0 (0.0)	20 (18.2)	<0.001
Drain placement	22 (8.8)	42 (38.2)	<0.001
Mean hospital stays (days)	1.8 ± 0.7	3.6 ± 1.4	<0.001
Postoperative complication	12 (4.8)	26 (23.6)	<0.001

Pericholecystic fluid was the strongest predictor (AOR 3.78, CI 2.06–6.94, p <0.001), followed by gallbladder wall thickness >3 mm (AOR 3.25, CI 1.89–5.60, p <0.001); previous acute cholecystitis (AOR 3.10, CI 1.80–5.34, p <0.001); impacted stone at neck/Hartmann's pouch (AOR 2.96, CI 1.68–5.22, p <0.001); and symptoms >72 hours (AOR 2.72, CI 1.58–4.68, p <0.001). These findings indicate that inflammatory changes and difficult gallbladder anatomy were the major independent determinants of difficult LC (*Table VII*).

Table VII: Multivariate Logistic Regression Analysis of Independent Predictors of Difficult LC

Variables	Adjusted OR	95% CI	p-value
Symptoms >72 hours	2.72	1.58–4.68	<0.001
Previous acute cholecystitis	3.1	1.80–5.34	<0.001
Raised total leukocyte count	2.08	1.17–3.70	0.013
Gallbladder wall thickness >3 mm	3.25	1.89–5.60	<0.001
Contracted gallbladder	2.38	1.34–4.23	0.003
Pericholecystic fluid	3.78	2.06–6.94	<0.001
Impacted stone at neck/Hartmann's pouch	2.96	1.68–5.22	<0.001

DISCUSSION

The present study found that laparoscopic cholecystectomy (LC) was difficult in 110 of 360 patients (30.6%), with an 18.2% conversion rate among difficult cases. This proportion is comparable to that reported in a previous observational study, in which intraoperative difficulty was noted in 37.1% of patients, and in another cross-sectional study, in which difficult LC was found in 24 of 72 patients (33.3%) [16,17]. In contrast, it was higher than the 15.4% reported in an observational study involving 338 patients and the 24.4% reported in a clinicoradiological assessment involving 180 patients [2,18]. Such differences may be explained by variation in case selection, inclusion of acute or recurrent inflammatory cases, surgeon experience, and different definitions of operative difficulty. Regarding patient characteristics, the mean age in this study was 46.2 ± 13.4 years, with patients aged >50 years more common in difficult LC than in easy LC (50.9% versus 28.8%, respectively; p<0.001). The mean age of 46.2 years is similar to the 46.67 years reported in a previous observational study, in which age >50 years was also significantly associated with difficult LC [16]. In this respect, a study of patients with acute cholecystitis identified increasing age as a risk factor for difficult LC, whereas another study of grade II acute cholecystitis found that male sex and surgery performed beyond 96 hours after symptom onset were independent factors associated with greater operative difficulty [19,20]. Male sex had a significantly higher association with difficulty than female sex (45.5% versus 31.2%, p=0.013), consistent with a previous study that reported an odds ratio of 5.76 for male sex [20]. Another significant factor in the present study was obesity. Specifically, BMI ≥25 kg/m^2 was more common in difficult LC than in easy LC (75.5% vs 55.2%; p<0.001). In a study conducted in a resource-limited setting, BMI >30 kg/m^2 was significantly correlated with difficult LC [21]. In addition, another study suggested that a high BMI was a relevant predictor of difficult laparoscopic cholecystectomy in patients with acute cholecystitis [22]. Some reasons for this association may include increased abdominal wall thickness, excessive fatty tissue around Calot's triangle, and greater difficulty with port placement and operative exposure. Furthermore, clinical inflammatory factors were strongly associated with operative difficulty. Symptoms

lasting >72 hours were present in 64.5% of difficult cases compared with 30.4% of easy cases (p<0.001). Previous acute cholecystitis was also more frequent in difficult LC (51.8% versus 18.4%; p<0.001). These findings align with a previous clinic radiological study, which identified recurrent attacks, elevated leukocyte count, increased gallbladder wall thickness, and pericholecystic collection as predictors of operative difficulty [18]. A study conducted in Bangladesh similarly reported technical difficulty in 64.3% of acute cholecystitis cases, with higher WBC counts (22.5 ± 15.9 versus 13.6 ± 4.7 $\times 10^9$/L) and longer operative times (101.16 ± 14.0 versus 54.3 ± 12.3 minutes) among difficult cases [8]. Consistent with these reports, the present study found that a raised leukocyte count was significantly more frequent in difficult LC than in easy LC (56.4% versus 20.0%; p<0.001). Ultrasonographic findings were also among the strongest predictors. In the present study, gallbladder wall thickness >3 mm was present in 69.1% of difficult cases compared with 28.4% of easy cases, while pericholecystic fluid was present in 44.5% versus 12.4%, respectively, with both associations reaching p<0.001. Supporting evidence from a previous study showed that gallbladder wall thickening >4 mm, pericholecystic fluid, hydrops, and other inflammatory radiological changes were associated with difficult LC [23]. Further, one study reported that an ultrasound scoring system predicted difficult LC with 80.7% sensitivity and 91.7% specificity, whereas another study reported an ultrasound scoring accuracy of 91.3% and a specificity of 95.5% [24, 25]. The present study also found an impacted stone at the neck or Hartmann's pouch in 50.9% of difficult cases compared with 18.0% of easy cases, consistent with a prospective study that identified gallbladder wall thickness and gallbladder size as important predictors of conversion [26]. Moreover, difficult LC was associated with poorer operative outcomes. Mean operative time was longer (93.5 ± 28.7 versus 54.6 ± 14.8 minutes), and hospital stay was prolonged (3.6 ± 1.4 versus 1.8 ± 0.7 days). Gallbladder perforation, bile or stone spillage, significant bleeding, drain placement, postoperative complications, and conversion were all significantly higher in difficult LC. These findings are consistent with a previous cross-sectional study, which reported longer operative time (95.3 ± 20.1 versus 54.7 ± 15.6 minutes) and a higher conversion rate (25.0% versus 0%) in difficult cases [17]. In a large validation study involving 12,844 patients, high-risk patients experienced difficult surgery in 80.0% of cases compared with 11.0% among low-risk patients, with an AUROC of 0.789 [27]. Similarly, another study evaluating a preoperative prediction scale reported an AUROC of 0.88, with a sensitivity of 75.15% and specificity of 88.31% [28].

LIMITATIONS

This was a single-center study with a limited sample size, which may restrict the generalizability of the findings. The assessment of operative difficulty may also vary according to surgeon experience and intraoperative judgment. Long-term postoperative outcomes were not evaluated.

CONCLUSION

This study concluded that difficult laparoscopic cholecystectomy was common among patients with gallstone disease and was mainly associated with prolonged symptoms, previous acute cholecystitis, raised leukocyte count, thickened gallbladder wall, pericholecystic fluid, and impacted stone. Careful preoperative assessment of clinical, laboratory, and ultrasonographic factors may help identify high-risk patients and improve surgical planning and patient safety.

RECOMMENDATIONS

Preoperative identification of risk factors in high-risk patients using clinical, laboratory, and ultrasonographic data is recommended. If the case is difficult, it should be handled by experienced surgeons who are prepared for complications and/or conversion. To establish a local risk prediction score, further multicentre studies are recommended.

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CONFLICT OF INTEREST

None declared

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