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Clinico-Radiological Assessment as A Predictor of Difficult Laparoscopic Cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the standard treatment for gallstone disease, but predicting difficult cases and conversion to open surgery remains challenging. This study aimed to identify preoperative clinic-radiological factors associated with difficult LC and conversion.

Methods: A retrospective cross-sectional study was conducted at the Manipal College of Medical Sciences, Pokhara, including 156 patients who underwent LC from January 2024 to June 2025. Demographic, clinical, laboratory, and ultrasonographic data were analyzed, with p-value<0.05 is considered significant.

Results: Among 156 patients, 109(69.9%) were female and 47(30.1%) males. Difficult LC was significantly associated with age ≥50 years, BMI ≥30 kg/m², multiple attacks, WBC >11,000/mm³, GB wall >3 mm, pericholecystic collection, and stone size >25 mm (p-value<0.05). Conversion to open surgery was significantly related to BMI ≥30, multiple attacks, GB wall >3 mm, pericholecystic collection, stone size >25 mm, and multiple stones (p-value<0.05).

Conclusion: Older age, obesity, recurrent attacks, raised WBC count, thickened gallbladder wall, pericholecystic collection, and larger or multiple stones were significant predictors of difficult LC and conversion. Recognizing these factors preoperatively aids in surgical planning and patient counselling, minimizing complications and conversion rates.

Keywords: conversion; difficult laparoscopic cholecystectomy; predictive factors.

INTRODUCTION

Laparoscopic cholecystectomy (LC) is the preferred technique for managing symptomatic gallstone disease due to its advantages of less postoperative pain, shorter hospital stay, faster recovery, and better cosmetic results compared to open cholecystectomy (OC).[1,2] However, the success and safety of LC depend on both the surgeon's expertise and the disease pathology.[3] Technical difficulties may arise from dense adhesions or altered anatomy around Calot's triangle.[4] Several clinical and ultrasonographic parameters-such as prolonged symptom duration, recurrent attacks, increased gallbladder wall thickness, large or multiple stones, and pericholecystic collections are associated with difficult LC or conversion to open cholecystectomy (OC).[5] Identifying these predictors preoperatively enables better surgical planning, patient counseling, and reduction of complications.[6] Therefore, this study aims to determine the clinical, laboratory, and imaging factors predicting difficult laparoscopic cholecystectomy in a tertiary care center.

METHODS

This hospital-based cross-sectional retrospective study was conducted in the Department of Surgery, Manipal College of Medical Sciences, Pokhara,

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Nepal, including 156 patients who underwent laparoscopic cholecystectomy (LC) for symptomatic gallstone disease from January 2024 to June 2025. Ethical approval was obtained from the Institutional Review Committee (IRC) of Manipal College of Medical Sciences, Pokhara. Patients aged 18 years or older, diagnosed with cholelithiasis, who underwent LC with complete medical and operative records were included, while those with incomplete data or directly operated by open method were excluded. Convenience sampling was used to include all eligible cases during the study period. Data were collected using a pre-designed questionnaire developed after an extensive literature review, and information regarding demographic, clinical, laboratory, ultrasonographic, and intraoperative parameters was obtained from hospital records. Confidentiality of data were maintained. Statistical analysis was performed using SPSS version 26.0; descriptive statistics were presented as frequency and percentage, while inferential statistics were analyzed using the Chi-square or Fisher's exact test with a p-value<0.05 considered significant.

RESULTS

Among the total participants, 47 (30.12%) were male and 109 (69.88%) were female, giving a female-to-male ratio of approximately 2.3:1. Half of the respondent (78; 50%) were aged below 50 years, while the remaining half (78; 50%) were 50 years or older. Regarding body mass index (BMI), 126 (80.76%) had a BMI <30 kg/m², and 30 (19.24%) had a BMI ≥30 kg/m² (Table 1).

Table 1. Socio demographic characteristics of the respondents. (n=156)

Characteristics	Frequency (%)
Age	
< 50 years	78(50.00)
≥50 years	78(50.00)
Sex	
Male	47(30.12)
Female	109(69.88)
BMI	
< 30 kg/m²	126(80.76)
≥30 kg/m²	30(19.24)

Table 2. Disease related characteristics of the respondents. (n=156)

Characteristics	Frequency (%)
Symptoms of patient	
Vomiting	
Yes	69(44.23)
No	87(55.77)
Fever	
Yes	22(14.10)
No	134(85.90)
Jaundice	
Yes	23(14.74)
No	133(85.26)
Murphy's Sign	
Yes	51(32.69)
No	105(67.31)
Duration of Symptoms	
≤ 1 year	78(50.00)
1 year	78(50.00)
Number of attacks	
No attacks	24(15.38)
Single	115(73.72)
Multiple	17(10.90)
WBC Counts	
≤ 11000	117(75.00)
>11000	39(25.00)
GB thickness	
≤ 3 mm	132(84.62)
>3 mm	24(15.38)
Pericholecystic collection	
Yes	14(8.97)
No	142(91.03)
Maximum Stone Size	
≤ 25 mm	150(96.15)
>25 mm	6(3.85)
Number of Stones	
Single	56(35.89)
Multiple	100(64.11)
History of previous abdominal surgery	
Yes	20(12.82)
No	136(87.18)

Table 2 summarizes the clinical and radiological characteristics of the study population. Among the respondents, 69(44.23%) presented with vomiting, 22(14.10%) with fever, and 23(14.74%) with jaundice. Murphy's sign was positive in 51(32.69%)

cases. Half of the patients 78(50%) had symptoms for ≤1 year, while the remaining half had symptoms for more than one year. Most participants 115(73.72%) reported a single attack of cholecystitis, whereas 17 (10.9%) experienced multiple attacks. Laboratory investigations revealed WBC count >11,000/mm³ in 39 (25%) patients. Ultrasonographic findings showed gallbladder (GB) wall thickness >3 mm in 24 (15.38%) and pericholecystic collection was detected in 14 (8.97%) cases. Regarding stones, 150 (96.15%) had stones ≤25 mm, and 100 (64.11%) had multiple stones. A history of previous abdominal surgery was present in 20 (12.82%) patients (Table 2).

Table 3 depicts the correlation between preoperative variables and the difficulty encountered during laparoscopic cholecystectomy. Patients aged ≥50 years were significantly more likely to have a difficult procedure compared to those <50 years (p-value=0.002). A BMI ≥30 was also strongly associated with difficulty (p-value=0.001). Likewise, patients with multiple attacks of cholecystitis had a significantly higher rate of difficult surgery (p-value=0.001). Radiological factors including WBC count >11,000/mm³ (p-value=0.002), GB wall thickness >3 mm (p-value=0.001) and presence of pericholecystic collection (p-value=0.008) were significantly correlated with operative difficulty. Maximum stone size >25 mm was another strong predictor (p-value=0.001). In contrast, sex, vomiting, fever, jaundice, Murphy's sign, duration of symptoms, number of stones and previous abdominal surgery were not significantly associated with difficult laparoscopic cholecystectomy (Table 3).

Conversion from laparoscopic cholecystectomy to open cholecystectomy was required in a limited number of patients; however, several preoperative factors showed significant association. BMI ≥ 30 was significantly related to conversion (p-value=0.001). Patients with multiple attacks (p-value=0.005) GB wall thickness >3 mm (p-value=0.013) and presence of pericholecystic collection (p-value=0.008) were also more likely to require conversion. Additionally, maximum stone size >25 mm (p-value=0.001) and multiple stones (p-value=0.026) were found

Table 3. Correlation between preoperative factors and difficulty in lap cholecystectomy.

Variables	Difficulty on lap cholecystectomy		Test value	p-value
	No, n	Yes, n		
Age				
< 50 years	73	5	9.652	0.002
≥50 years	59	19		
Sex				
Male	40	7	0.012	0.911
Female	92	17		
BMI				
< 30 kg/m²	114	12	17.288	0.001
≥30 kg/m²	18	12		
Vomiting				
Yes	59	10	0.076	0.783
No	73	14		
Fever				
Yes	19	3	0.06	0.086
No	113	21		
Jaundice				
Yes	18	5	0.837	0.36
No	114	19		
Murphy's sign				
Yes	42	9	0.298	0.585
No	90	15		
Duration of symptoms				
≤ 1 year	73	5	0.009	0.926
>1 year	59	19		
Number of attacks				
Single	102	13	19.64	0.001
Multiple	6	11		
WBC counts				
≤ 11000	105	12	9.455	0.002
>11000	27	12		
GB thickness				
≤ 3mm	117	15	10.657	0.001
>3mm	15	9		
Pericholecystic collection				
Yes	6	8	6.937	0.008
No	126	16		
Maximum stone size				
≤ 25mm	130	20	13.836	0.001
>25mm	2	4		
Number of stones				
Single	51	5	3.447	0.178
Multiple	81	19		
History of previous abdominal surgery				
Yes	15	5	1.629	0.202
No	117	19		

Note: p-value <0.05 is significant.

Table 4. Correlation between preoperative factors and conversion in LC.

Variables	Conversion		Test value	p-value
	Yes, n	No, n		
Age				
< 50 years	7	71	2.948	0.086
≥50 years	2	76		
Sex				
Male	2	45	0.284	0.594
Female	7	102		
BMI				
< 30 kg/m²	3	123	13.83	0.001
≥30 kg/m²	6	24		
Vomiting				
Yes	3	66	0.46	0.498
No	6	81		
Fever				
Yes	3	19	2.916	0.088
No	6	128		
Jaundice				
Yes	3	20	2.626	0.105
No	6	127		
Murphy's Sign				
Yes	5	46	2.269	0.132
No	4	101		
Duration of Symptoms				
≤ 1 year	7	71	0.273	0.602
>1 year	2	76		
Number of attacks				
Single	5	110	12.7	0.005
Multiple	4	13		
WBC Counts				
≤ 11000	6	11	0.354	0.552
>11000	3	36		
GB thickness				
≤ 3mm	5	127	6.19	0.013
>3mm	4	20		
Pericholecystic collection				
Yes	6	8	6.937	0.008
No	3	139		
Maximum Stone Size				
≤ 25mm	6	144	22.45	0.001
>25mm	3	3		
Number of Stones				
Single	0	56	7.26	0.026
Multiple	9	91		
History of previous abdominal Surgery				
Yes	6	14	3.59	0.058
No	3	133		

Note: p-value <0.05 is significant.

to be significant predictors of conversion to open cholecystectomy. No statistically significant correlation was observed with age, sex, vomiting, fever, jaundice, Murphy's sign, duration of symptoms counts or previous abdominal surgery (Table 4).

DISCUSSION

Laparoscopic cholecystectomy has largely replaced open surgery as the standard treatment for symptomatic gallbladder stones, a condition that frequently challenges surgeons in their daily practice. Although the majority of cases are completed laparoscopically, a small proportion still require conversion to open cholecystectomy, which can present technical challenges and patient discomfort. Patient satisfaction and experience extend beyond the simplicity of the procedure or hospital stay duration. They also depend on the recurrence of post-operative symptoms that can affect overall quality of life. Therefore, identifying predictors of intraoperative difficulty is essential for optimizing surgical planning and improving patient outcomes. Recognizing these predictors has practical value for pre-operative planning operative risk stratification and patient counseling.

This study mainly carried out to identify the preoperative predictors for difficult laparoscopic cholecystectomy in 156 patients, where 69.88% were female, 50% cases were of age group < 50 years and majority (80.76%) patients had BMI <30 kg/m2. The study revealed 24/156 procedure were difficult during LC procedure and among them 11/156 (7.05%) converted to open cholecystectomy. The conversion rate of Lap cholecystitis in contemporary studies has been reported to vary from 0.18% to 30%, with minimal conversion rate in this study.[7-9] In our study, variables such as age > 50 years, BMI ≥ 30 kg/m², raised WBC count (>11,000/mm³), gall-bladder wall thickness >3 mm, pericholecystic collection, and larger or multiple stones were significantly associated with increased difficulty during LC. These findings are consistent with multiple studies reporting similar predictive factors.[10-13] Elevated

WBC and thickened gall-bladder wall usually reflect acute inflammation, fibrosis, and adhesions, which obscure Calot's triangle and make dissection more demanding. In contrast some studies revealed age, BMI and GB wall thickness wasn't the significant predictors.[14-16]

The presence of pericholecystic fluid also correlated with operative difficulty in our series, in agreement with findings by Stoica et al. and Teerawiwatchai et al., who both emphasized ultrasonographic signs of inflammation as reliable predictors of difficult LC.[12,13] Inflammation and edema lead to tissue friability and poor anatomical visualization, prolonging operative time and increasing risk of bile duct injury. Regarding conversion to open cholecystectomy, significant associations were observed with BMI ≥30, gall bladder wall >3 mm, pericholecystic collection, stone size >25 mm, multiple stones, and multiple attacks. These results are in line with those of Ramakrishnan et al. (2025), who found that gall-bladder wall thickness and stone size were the strongest predictors of conversion.[17] Similarly, a 2023 prospective study by Singh et al. demonstrated that increased BMI, history of recurrent attacks, and thickened gall-bladder wall independently increased the likelihood of conversion.[18] Although male sex and older age were not statistically significant predictors of conversion in our study, several other investigations have noted these as important demographic determinants.[19,20] This discrepancy could be attributed to differences in sample size, selection bias, and case mix (acute vs chronic cholecystitis).The duration of symptoms >1 year was significantly related to intraoperative difficulty but not to conversion, consistent with the observation that chronic inflammation produces dense adhesions yet may still be managed laparoscopically by experienced surgeons.

Overall, our results reinforce that ultrasonographic parameters particularly gall bladder wall thickness and pericholecystic fluid serve as the most reliable preoperative indicators of both difficulty and conversion. These are objective, easily obtainable, and reproducible findings that should be incorporated into preoperative risk-assessment models.[13, 17,21] A composite preoperative score, incorporating clinical (age, BMI, number of attacks), laboratory (WBC count), and imaging (wall thickness, pericholecystic collection, stone characteristics) parameters, may provide better predictive accuracy.[12,21] Such scoring systems enable surgeons to triage high-risk cases, ensure senior supervision, prepare necessary instruments, and counsel patients regarding the possibility of conversion or complications.[22]

In summary, preoperative factors such as increased BMI, elevated WBC count, thickened gall-bladder wall, pericholecystic collection, larger or multiple stones, and recurrent attacks were significantly associated with difficult LC and conversion to open surgery. Recognition of these factors allows for improved operative planning, reduced complications, and enhanced patient outcomes.

Limitations

The study was confined into only one setting with limited sample size so generalization of the findings might be difficult.

CONCLUSIONS

Laparoscopic cholecystectomy remains the gold standard treatment for symptomatic gallstone disease, yet operative difficulty and conversion to open surgery continue to challenge surgeons. In this study, BMI ≥30 kg/m², increased WBC count (>11,000/mm³), gall-bladder wall thickness >3 mm, pericholecystic collection, larger stone size (>25 mm), multiple stones, and recurrent attacks were significantly associated with increased difficulty and conversion rates. Preoperative evaluation of these variables allows surgeons to anticipate potential challenges, optimize surgical preparation, and counsel patients effectively regarding intraoperative risks. Incorporating these predictors into a preoperative scoring model may improve operative planning, reduce complications, and enhance overall outcomes.

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