Section: General Surgery

Original Research Article

PREOPERATIVE PREDICTORS OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY: A CROSS-SECTIONAL OBSERVATIONAL STUDY FROM A SOUTH INDIAN TERTIARY HOSPITAL

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Received *: 07/10/2025*
Received in revised form *: 16/11/2025*
Accepted *: 02/12/2025*

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DOI: 10.70034/ijmedph.2025.4.419

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (4); 2323-2327

ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the gold-standard treatment for symptomatic gallstone disease, yet a significant proportion of cases remain technically challenging due to anatomical distortion and inflammation. Identifying preoperative predictors of difficult LC is crucial for optimizing surgical planning, minimizing complications, and improving outcomes. Evidence from South Indian settings remains limited.

Materials and Methods: A hospital-based cross-sectional observational study was conducted in the Department of General Surgery, Government Medical College, Kannur, from 2023 to 2024. Fifty consecutive adult patients undergoing LC who met the inclusion criteria were enrolled after informed consent. Patients with gallbladder malignancy or common bile duct stones/stenting were excluded. Preoperative clinical parameters and ultrasonographic findings were recorded. Difficult LC was defined as an operative duration >150 minutes accompanied by at least one intraoperative difficulty criterion.

Results: Among the 50 participants, the mean age was 45 years, and 76% were female. Difficult LC occurred in 20 patients (40%). Conversion to open surgery was required in one case (2%). Significant preoperative predictors of difficult LC included previous episodes of acute cholecystitis ($p < 0.001$), gallbladder wall thickening >3 mm ($p < 0.001$), pericholecystic collection ($p < 0.001$), and impacted stone at the gallbladder neck ($p < 0.001$). Age, gender, body mass index, abdominal scars, and hepatomegaly showed no statistically significant association with operative difficulty.

Conclusion: Preoperative ultrasonographic findings—particularly gallbladder wall thickening, pericholecystic fluid, and impacted neck stones—along with a history of acute cholecystitis, strongly predict difficult LC. Incorporating these parameters into routine preoperative evaluation may help surgeons anticipate complexity, allocate resources more effectively, and reduce operative risks.

Keywords: Laparoscopic cholecystectomy, Difficult cholecystectomy, Preoperative predictors, Gallbladder wall thickening, Pericholecystic collection, Ultrasonography.

INTRODUCTION

Gallbladder stones are the most common biliary pathology, and laparoscopic cholecystectomy (LC) remains the gold-standard treatment for symptomatic cholelithiasis, making it one of the most frequently performed operations worldwide.[1] Since its introduction, LC has transformed minimally invasive surgery,[2-4] offering advantages such as shorter hospital stay, early oral intake, reduced postoperative pain, faster return to normal activities, and superior cosmesis.[5-7] These benefits

have contributed to a nearly 20% rise in cholecystectomy rates following the adoption of laparoscopy.[8] After the first open cholecystectomy in 1882, the first LC was performed by Erich Muhe in 1985,[9] paving the way for continuous innovations, including single-incision and robotic approaches.

Despite advancements, 3–10% of LCs still require conversion to open surgery.[10] Several factors have been associated with difficult LC or conversion, including acute cholecystitis, anatomical variations, dense adhesions, advanced age, male gender, prior upper abdominal surgery, history of pancreatitis, gallbladder wall thickening, pericholecystic fluid, inadequate instrumentation, and intraoperative events like uncontrolled bleeding or organ injury.[11] Identifying such preoperative predictors is crucial for anticipating operative difficulty, improving planning, minimizing complications, and ensuring better patient outcomes. This study aims to create a database of preoperative factors associated with difficult laparoscopic cholecystectomy in a tertiary care teaching hospital in north Kerala.

MATERIALS AND METHODS

This hospital-based cross-sectional observational study was conducted in the Department of General Surgery at Government Medical College, Kannur, during 2023–2024. All patients admitted for laparoscopic cholecystectomy who met the eligibility criteria were considered for inclusion after obtaining approval from the Institutional Research Committee and the Institutional Ethics Committee.

The study population comprised adult patients above 18 years of age who were admitted for and subsequently underwent laparoscopic cholecystectomy in the General Surgery department. Patients with gallbladder malignancy or common bile duct stones/stenting were excluded. Following informed written consent, participants underwent detailed clinical examination and ultrasonographic assessment. Postoperatively, cases were categorized as easy or difficult laparoscopic cholecystectomies using predefined criteria developed prior to study commencement.

Data entry was performed using Microsoft Excel, and statistical analysis was conducted using SPSS version 21. Continuous variables were summarized as mean ± standard deviation or median with interquartile range, depending on the normality of distribution, while categorical variables were expressed as frequencies and proportions. Qualitative variables were compared between outcome groups using the Chi-square test, with $p < 0.05$ considered significant. Ethical considerations were strictly adhered to throughout the study.

RESULTS

A total of 50 patients met the inclusion criteria and were enrolled in the study.The baseline preoperative clinical characteristics are summarized in [Table 1]. More than two-thirds (64%) of participants were ≤50 years old, with a mean age of 45 years. Females constituted the majority (76%) of the study population. Nearly half of the participants were obese (46%). A previous history of acute cholecystitis was present in 38%, and 36% had abdominal scars from prior surgeries.

Preoperative ultrasonographic findings are detailed in [Table 2]. A thickened gallbladder wall (>3 mm) was noted in 30% of patients, while 16% demonstrated pericholecystic collection. An impacted stone at the gallbladder neck was observed in 14% of the cohort. Only 12% had hepatomegaly or features suggestive of chronic liver disease. These radiological parameters were evaluated as potential predictors of difficult laparoscopic cholecystectomy.

Postoperative outcomes are shown in [Table 3]. Based on the predefined criteria—operative time >150 minutes plus the presence of at least one additional difficulty parameter—20 patients (40%) were categorised as having undergone a difficult laparoscopic cholecystectomy. Mean operative time across the cohort was 110 minutes. Cystic duct or arterial injury contributed to difficulty in 16% of patients. Bile or stone spillage occurred in 22% of cases, and conversion to open surgery was required in one patient (2%).

The association between preoperative factors and difficulty level is presented in [Table 4]. A statistically significant relationship was observed between difficult laparoscopic cholecystectomy and prior history of acute cholecystitis ($p < 0.001$), thickened gallbladder wall ($p < 0.001$), presence of pericholecystic collection ($p < 0.001$), and stone impacted at the gallbladder neck ($p < 0.001$). No significant association was noted with age, gender, BMI, abdominal scars, or hepatomegaly.

Table 1: Preoperative clinical characteristics of study participants

Characteristics	Frequency (%)
Age group	
≤ 50 years	32 (64%)
>50 years	18 (36%)
Gender	
Male	12 (24%)
Female	38 (76%)
Previous h/o A/c cholecystitis	
Yes	19 (38%)
No	31 (62%)
BMI	

Obese	23 (46%)
Non obese	27 (54%)
Abdominal scar	
Yes	18 (36%)
No	32 (64%)

Table 2: Preoperative radiological characteristics of study participants

Characteristics	Frequency (%)
Hepatomegaly/ Cirrhotic Liver	
Yes	6 (12%)
No	44 (88%)
Gall bladder wall thickness	
Thin	35 (70%)
>3mm	15 (30%)
Pericholecystic collection	
Yes	8 (16%)
No	42 (84%)
Stone at the neck of the GB/ impacted stone	
Yes	7 (14%)
No	43 (86%)

Table 3: Postoperative characteristics of the study participants

Characteristics	Frequency (%)
Time taken	
≤150 minutes	30 (60%)
>150 minutes	20 (40%)
Bile/ stone spillage	
Yes	11 (22%)
No	39 (78%)
Cystic duct/ arterial injury	
Yes	8 (16%)
No	42 (92%)
Open conversion	
Yes	1 (2%)
No	49 (98%)
Difficulty level	
Easy	30 (60%)
Difficult	20 (40%)

Table 4: Comparison of variables between those who have undergone a difficult cholecystectomy vs Easy cholecystectomy

Characteristics	Total	Difficult	Easy	P value
Age group				0.904
≤50 years	32	13	19	
>50 years	18	7	11	
Gender				0.999
Male	12	5	7	
Female	38	15	23	
Previous h/o a/e cholecystitis				<0.001
Yes	19	14	5	
No	31	6	25	
BMI				0.297
Obese	23	11	12	
Non-obese	27	9	18	
Abdominal scar				0.279
Yes	18	9	9	
No	32	11	21	
Hepatomegaly / Cirrhotic liver				0.202
Yes	6	4	2	
No	44	16	28	
GB wall thickness				<0.001
Thin	35	7	28	
>3 mm	15	13	2	
Pericholecystic collection				<0.001
Yes	8	7	1	
No	42	13	29	
Stone at neck of Gall Bladder / impacted stone				<0.001
Yes	7	6	1	
No	43	14	29	

DISCUSSION

Cholecystectomy remains one of the most unpredictable operations in general surgery due to wide variations in intraoperative anatomy and disease severity. Multiple factors—including inflammation, fibrosis, anatomical distortion, instrumentation, and surgeon experience—contribute to this variability. Although laparoscopic cholecystectomy has become the gold-standard treatment, predicting difficult procedures continues to be clinically relevant.[1-4] In this hospital-based cross-sectional observational study conducted at Government Medical College, Kannur, we sought to identify preoperative clinical and radiological parameters associated with difficult laparoscopic cholecystectomy in a South Indian cohort, an area with relatively sparse literature.

In our study, a difficult cholecystectomy was defined as an operative duration exceeding 150 minutes and at least one additional difficulty parameter. The mean age of the participants was 45 years. Although several studies have shown that age >50 years is a predictor of difficult laparoscopic cholecystectomy, we did not find a statistically significant association ($p = 0.904$).[12,13] Unequal age distribution may explain this discrepancy, although repeated episodes of inflammation and higher rates of previous surgeries in older patients theoretically increase the likelihood of fibrosis and adhesions at Calot's triangle. Female predominance (3:1) was consistent with the global epidemiology of cholelithiasis; however, unlike previous studies by Lee NW et al. and Kanaan SA et al., male gender was not a statistically significant predictor in our study ($p = 0.999$), likely due to the limited sample size and unequal sex distribution.[14,15]

Among the assessed variables, previous acute cholecystitis emerged as a strong determinant of complex surgery ($p < 0.001$). Recurrent inflammation is known to cause progressive gallbladder wall thickening, scarring, and dense adhesions between the gallbladder, liver bed, and adjacent structures, complicating dissection. This finding aligns with prior observations from Randhawa JS et al. and Agarwal N et al.[16,17] Obesity, present in 46% of participants, is known to pose technical challenges, including difficult port placement and obscured anatomy due to intraperitoneal fat. Although 47% of obese patients in our study experienced a difficult procedure, the association was not statistically significant ($p = 0.297$), possibly due to the small sample size and single-centre design.

Radiological predictors, particularly thickened gallbladder wall, were strongly associated with difficult cholecystectomy ($p < 0.001$), corroborating findings from Fried GM et al.[18] Thick walls impair grasping and manipulation and are often markers of chronic inflammation. Pericholecystic fluid was another significant predictor ($p < 0.001$), with 87.5% of affected patients experiencing difficult surgery; similar findings have been reported by Simopoulos et al.[19] An impacted stone at the gallbladder neck also significantly predicted operative difficulty ($p < 0.001$), consistent with Lal P et al,[20] as such stones distend the gallbladder and hinder retraction at Calot's triangle. Other factors, such as adhesions and anatomical variations, although important contributors to operative difficulty, are not reliably detected on routine ultrasonography. Finally, surgeon expertise remains an indispensable determinant of operative time and complexity, underscoring the importance of adequate training and graded exposure in laparoscopic surgery.

CONCLUSION

In this study, several preoperative clinical and ultrasonographic factors—particularly previous acute cholecystitis, thickened gallbladder wall, pericholecystic collection, and impacted neck stones—were found to predict difficult laparoscopic cholecystectomy significantly. Identifying these determinants preoperatively can help surgeons anticipate operative challenges and plan accordingly to minimize complications. Although age, gender, and obesity showed no statistically significant association in our cohort, larger multicenter studies may provide further clarity. Incorporating these predictors into routine preoperative assessment may ultimately improve surgical outcomes and patient safety.

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