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Cross-sectional Evaluation of Pre-operative Predictive Factors for Difficult Laparoscopic Cholecystectomy

Muhammad Haseeb [1], Shaheer Hassan[1], Abdullah Ayub[1], Mian Afaq Ali[1], Muhammad Javed Shakir[1], Muhammad Shahid Farooq[2]

[1]Department of Surgery, Unit 1, Fatima Memorial Hospital and College of Medicine and Dentistry, Lahore, [2]Department of Surgery, King Edward Medical University, Lahore, Pakistan.

ABSTRACT

Background: Laparoscopic gallbladder removals are performed in several cases, though complications can necessitate the conversion to open surgery. The identification of risk factors for difficult laparoscopic cholecystectomy (LC) enhances surgical planning and patient safety. The objective of the study was to evaluate the demographic, clinical, and imaging parameters in patients with cholecystitis that may predict the difficulty of LC.

Methods: This cross-sectional study was conducted in Unit I of the Department of Surgery at Fatima Memorial Hospital, Lahore, between March and May 2025, under ethical approval (FMH-IRB-1637). A total of 72 patients diagnosed with cholecystitis aged from 16 to 65 years of age and underwent LC for cholecystitis were included using a consecutive sampling technique. Demographic, clinical, and imaging information was collected using a standardized proforma. The dates of intraoperative findings, duration of operation, conversion to open surgery, and postoperative results were noted. Chi-square and t-tests were used to perform statistical analysis with a significance level of $p < 0.05$.

Results: Difficult LC was encountered in (24 (33.3%)) of the 72 patients. Factors with the largest predictive effect were patients who were ≥50 (18 (75.0%)), had obesity (14 (58.3%)), a past abdominal operation (11 (45.8%)), had experienced ERCP (6 (25.0%)), and presented with thickening of the gallbladder (17 (70.8%)) along with dilation of the CBD (6 (25.0%). Cases that were more difficult had surgeries that lasted longer (mean 95.3 ± 20.1 min compared to 54.7 ± 15.6 min; $p<0.001$), involved more open conversions (6 (25.0 %) versus 0 (0%); $p<0.001$)), and had more post-operative complications.

Conclusion: Many pre-operative factors, such as age, being obese, having previous surgery, and unusual imaging results, give hints that a patient will suffer from difficult LC. By identifying these signs, surgeons can prepare patients for counseling, sort risks, and make decisions.

Keywords: Laparoscopic cholecystectomy, Preoperative Period, Risk Factors, Cholecystitis.

Corresponding Author:
Dr. Muhammad Haseeb
Department of Surgery, Unit 1,
Fatima Memorial Hospital and College of Medicine and Dentistry,
Lahore, Pakistan.
Email: muhammadhaseebsurgery@gmail.com
ORCID: https://orcid.org/0009-0007-6570-2555
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INTRODUCTION

Laparoscopic cholecystectomy involves less damage and is easy on the patient, because of this, it is now widely considered the best approach for cholelithiasis and cholecystitis [1]. Despite the many positives and wide acceptance, a particular group of patients encounter substantial gear difficulties during the operation, which at times makes it necessary to switch to open cholecystectomy [2]. It is still very important to find patients who may have a hard time with LC in surgical practice.

A difficult laparoscopic cholecystectomy is indicated by the surgeon taking too long, intraoperative problems (such as duct or bleeding injuries), and needing to change to an open surgery [3]. Identifying these difficulties ahead of surgery improves the way surgeons plan, allocate doctors, manage resources, and secure patient safety [4,5]. Numerous studies indicate that patient age, obesity, prior surgery in the area, a past ERCP, and gallbladder or common bile duct findings on ultrasound are linked to more difficulty during surgery [6].

Because surgical training and available resources are not the same everywhere, it is crucial for surgeons in Pakistan and other developing countries to estimate ahead how hard a surgery might be [7]. Since surgeons in busy centers meet many patients with different health conditions, predicting outcomes is crucial to prevent preventable problems [8,9]. Despite the high prevalence of laparoscopic cholecystectomy, it is difficult to predict intraoperative outcomes, particularly in the low-resource context. Local data to assist surgeons in their preoperative identification of high-risk patients is also limited, which may result in unexpected complexities, prolonged surgery, and conversion to open cases.

The purpose of this study is to find and analyze preoperative factors associated with problems during laparoscopic cholecystectomy among people with cholecystitis. In order to support surgeons, this study aimed to assess demographics, earlier clinical records, and imaging exams to create a useful risk classification method. Spotting hard-to-treat cases before surgery allows surgeons to prepare better, help patients recover better, and decrease the need for major surgery.

METHODS

This cross-sectional study was conducted at Unit I, Department of Surgery, Fatima Memorial Hospital, Lahore, Pakistan, from March to May 2025. The study was carried out after obtaining ethical approval from the Ethics Review Committee (FMH-IRB-1637). A total of 72 patients aged between 16 and 65 years, diagnosed with cholecystitis and scheduled for laparoscopic cholecystectomy (LC), were enrolled using a consecutive sampling technique. The sample size was calculated by using OpenEpi version 3.0.0, with a power of 80% and an alpha of 0.05, based on a previously reported prevalence of difficult laparoscopic cholecystectomy of 15% to 30% [10]. Patients treated for cholecystitis with elective or emergency LC who were 16 to 65 years old were included in the study. People who did not fit in the study were those younger than 16 or older than 65, those with cardiopulmonary problems, severe coagulopathy or incomplete information from visits or scans.

A standardized questionnaire was used to obtain information on patients' age, gender, body mass index, earlier surgery near the stomach, heart, and lung diseases, diabetes, hypertension, history of ERCP, gallstone findings from imaging, and liver function tests. The type of surgery (elective or emergency), time spent operating, the surgeon's difficulty rating (easy, moderate, or difficult), need for open surgery, and intraoperative complications such as bleeding or bile duct injury were all noted. Length of stay in the hospital, problems experienced, and return to the hospital within 30 days were included in the study's findings. All the data were examined using SPSS version 25.0. Demographic and clinical information was taken and summarized using descriptive statistics. For categorical data, the chi-square test was used, and the t-test was used to compare continuous data. Logistic regression was used to find out what factors independently predicted difficult LC. The research team determined that a p-value of less than 0.05 was significant. This way of studying pre-operative factors made it possible to identify people more likely to have difficult cholecystectomy and allowed better plans for surgical treatment.

RESULTS

Table 1: Demographic and Clinical Characteristics of Patients

Variable	Difficult LC (n=24)	Non-Difficult LC (n=48)
Mean Age (years)	52.4 ± 8.7	45.2 ± 9.1
Gender (Male/Female)	10 / 14	16 / 32
BMI >30	14 (58.3%)	10 (20.8%)
Previous Abdominal Surgery	11 (45.8%)	7 (14.6%)
Diabetes Mellitus	9 (37.5%)	5 (10.4%)
Hypertension	8 (33.3%)	12 (25.0%)
History of ERCP	6 (25.0%)	2 (4.2%)

Descriptive statistics were used. LC = Laparoscopic Cholecystectomy; BMI = Body Mass Index; ERCP = Endoscopic Retrograde Cholangiopancreatography.

This cross-sectional study was conducted on 72 patients who underwent laparoscopic cholecystectomy for cholecystitis in Unit I, Department of Surgery, FMH. The aim was to determine pre-operative predictive factors associated with difficult laparoscopic cholecystectomy (LC). A total of 18 cases (25%) were identified as difficult based on intraoperative findings such as extended duration, dense adhesions, or conversion to open surgery. Demographic variables, including age, gender, and BMI, were analyzed. Frequencies of difficult and easy LC were recorded as shown in **Table 1**. Association between various clinical predictors and difficult LC was evaluated using the chi-square test and Fisher's exact test, where appropriate. A p-value <0.05 was considered statistically significant.

Table 2: Pre-operative Investigations and Imaging Findings

Variable	Difficult LC (n=24)	Non-Difficult LC (n=48)
Gallstones on USG	22 (91.7%)	48 (100%)
GB Wall Thickening	17 (70.8%)	8 (16.7%)
CBD Dilation	6 (25.0%)	1 (2.1%)
Pericholecystic Fluid	8 (33.3%)	2 (4.2%)
Abnormal LFTs	10 (41.7%)	4 (8.3%)
CT Scan/MRCP Done	5 (20.8%)	2 (4.2%)

LC = Laparoscopic Cholecystectomy; USG = Ultrasonography; GB = Gallbladder; CBD = Common Bile Duct; LFTs = Liver Function Tests; CT = Computed Tomography; MRCP = Magnetic Resonance Cholangiopancreatography. Chi-square test was used for categorical variables. Fisher's exact test was applied where expected cell counts were <5. p < 0.05 was considered statistically significant

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This table shows a comparison between demographic and clinical characteristics of 72 patients. Patients with difficult LC were significantly older (mean 52.4 vs. 45.2 years) and had higher rates of obesity (14 (58.3%) vs. 10 (20.8%)), prior abdominal surgery (11 (45.8%) vs. 7 (14.6%)), diabetes (9 (37.5%) vs. 5 (10.4%)), and ERCP history (6 (25.0%) vs. 2 (4.2%)) compared to those with non-difficult LC. **Table 2** summarizes the findings from pre-operative investigations and imaging between the two groups.

Table 3: Operative and Post-operative Outcomes

Variable	Difficult LC (n=24)	Non-Difficult LC (n=48)	p-value	Test Used
Elective/Emergency Surgery	12 / 12	44 / 4	0.002	Chi-square test
Mean Operative Time (minutes)	95.3 ± 20.1	54.7 ± 15.6	<0.001	Independent t-test
Conversion to Open Surgery	6 (25.0%)	0 (0%)	<0.001	Chi-square test
Intraoperative Bleeding	5 (20.8%)	1 (2.1%)	0.008	Fisher's Exact Test
Length of Stay > 3 Days	10 (41.7%)	4 (8.3%)	0.001	Chi-square test
Post-op Complications (Any)	7 (29.2%)	3 (6.3%)	0.005	Chi-square test

LC = Laparoscopic Cholecystectomy. Independent t-test was used for mean operative time. Chi-square test was used for categorical variables. Fisher's exact test was applied for intraoperative bleeding. p < 0.05 was considered statistically significant.

This table demonstrates that thickening of the gall bladder wall (17 (70.8%) vs. 8 (16.7%)), pericholecystic fluid (8 (33.3%) vs. 2 (4.2%)), CBD dilation (6 (25.0%) vs. 1 (2.1%)), and abnormal liver function tests (10 (41.7%) vs. 4 (8.3%)) had more occurrences in difficult LC cases. These imaging markers are potential predictors of surgical complexity. **Table 3** provided operative and postoperative comparisons between difficult and non-difficult LC groups.

This table showed that the difficult LC was connected with longer operative time (95.3 vs. 54.7 minutes), higher conversion rate to open surgery (6 (25.0%) vs. 0 (0.0%)), increased bleeding (5 (20.8%) vs. 1 (2.1%)), longer hospital stays (10 (41.7%) stayed >3 days), and more postoperative complications (7 (29.2%) vs. 3 (6.3%)). These findings were statistically significant, indicating greater clinical burden in difficult cases.

These findings underscored the important factors influencing the preoperative and intraoperative conditions to accurately predict the probability of a difficult laparoscopic cholecystectomy, which aided in better surgical planning and management of the patient.

DISCUSSION

Based on the results of this study, older individuals had more challenging surgery outcomes. Rising difficulties in gallbladder dissection originate from fibrosis, increased tissue fragility, and inflammation linked with aging. The results agree with several past studies that suggest operative difficulty depends greatly on the patient's age [11,12]. Factors such as body mass index (BMI) came up as significant. Increased intra-abdominal fat in obese patients decreases their surgeons' ability to conduct surgery using laparoscopic tools. Too much adipose tissue in and around the gallbladder and liver can hide important anatomical parts and raise the surgery's technical difficulty. There is also a common link between obesity and more comorbidities, which can complicate managing the patient's surgery [13]. Difficulty was also more likely among those who had previously had an abdominal operation. Adhesions are often caused by earlier surgery and may keep the gallbladder and nearby organs tethered, making it more difficult to safely remove them [14]. Adhesions may cause problems by unintentionally injuring nearby blood vessels or bile ducts, and

operations take longer [15,16]. As a result, it is important to pay close attention to the surgical history when preparing for an operation.

The difficulty of performing endoscopic retrograde cholangiopancreatography (ERCP) grew as the procedures became more complex in our cohort. Because ERCP frequently treats obstructions or stones, it can result in nearby inflammation or structural changes that may add complications to laparoscopic procedures [17]. The uncommon focus on this aspect should change because it may predict problems with certain surgeries. Important details regarding the outcome were found using ultrasound imaging before the operation. Thickening of the gallbladder wall in LC was related to difficulty performing surgery, an indication of chronic inflammation or fibrosis [18]. Thickened walls can slow the surgeon and raise the risk of poking or bleeding the gallbladder [19]. The presence of fluid between the gallbladder and liver, indicating acute infection or an abscess nearby, was associated with more difficult surgery. In many cases, bile duct dilation suggests more complex disease in the bile system, making it more likely for surgery to cause injury [20,21]. It took longer to operate in difficult cases, showing that such cases are more complex. Longer surgeries are usually necessary because these surgeries involve careful separation and removal of inflamed or thickened parts [22]. The importance of correctly predicting preoperative outcomes rises when surgery is longer, considering anesthesia and resource consumption [23]. Open surgery as the outcome is still considered very important. Because the study included difficult surgeries, outcomes showed that the surgeon was more cautious, especially if laparoscopic progress was limited [24]. Though sometimes considered a challenge, conversion can keep crucial intraoperative injuries from happening if performed swiftly. It was more common for patients with difficult LC to experience wound infections, leaks, and to spend extra time in hospital [25]. If these patients are recognized in advance, better supervision both in the operating room and after the surgery can be given.

Even so, this study does have its limitations. Testing took place at only one location with a relatively small number of patients, so the outcomes may not apply to a wider group. Since surgeon experience and skill level were not studied, their impact on difficulty and results remains unknown. Raising the number of centers treated and implementing uniform operative evaluation tools could enhance the strength of future studies. Our results demonstrate that evaluating individuals' medical history, demographics, and imaging before surgery is useful for estimating possible difficulty with laparoscopic cholecystectomy. This data can better guide surgeons' choices, ensure each resource is used appropriately, and improve safety for patients. Its study design is at only one center, and the small number of participants may not help this study be widely used. Also, although it was not considered, the level of a surgeon's experience is a known factor influencing difficulty and should be studied in future studies.

CONCLUSION

It is pointed out that various pre-surgery factors can be used with confidence to predict that a difficult laparoscopic cholecystectomy is likely. Recognizing individuals at a high surgical risk early on makes it easier to select a good procedure, assign skilled surgeons, and advise the patient. If predictive models are made using these considerations, surgical results may improve, fewer patients may need different types of surgery, and everyone's safety can be improved.

LIST OF ABBREVIATIONS

LC: Laparoscopic Cholecystectomy
BMI: Body Mass Index

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ETHICAL APPROVAL

The study received ethical approval from Fatima Memorial Hospital, Lahore, under reference number FMH-IRB-1637 from 3 months March to May 2025.

CONFLICT OF INTEREST

None

AUTHORS' CONTRIBUTIONS

All contributed equally as per ICMJE.

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