



Research Article

Evaluation Of Clinico-Radiological Factors Predicting Difficult Laparoscopic Cholecystectomy

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ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the gold standard for symptomatic gallstone disease. However, a subset of cases remains technically difficult, increasing the risk of complications and conversion to open surgery.

Aim: To evaluate clinico-radiological and laboratory factors predicting difficult LC.

Methods: A prospective observational study was conducted on 120 patients undergoing LC at the Integral Institute of Medical Sciences, Lucknow (Jan 2024–Mar 2025). Clinical, laboratory, and ultrasonographic parameters were recorded. Intraoperative difficulty was graded as easy, difficult, or very difficult. Statistical correlation was analyzed.

Results: Mean patient age was 44.2 ± 11.8 years; females comprised 70%. Difficult and very difficult LC were encountered in 28.3% and 11.7% cases, respectively, with a conversion rate of 6.7%. Significant predictors of difficult LC were **BMI ≥ 25 kg/m² ($p=0.001$), recurrent cholecystitis, raised total leukocyte count ($p=0.001$), gallbladder wall thickness >3 mm ($p<0.001$), impacted neck stone ($p=0.04$), and pericholecystic fluid ($p=0.03$).**

Conclusion: Obesity, recurrent cholecystitis, inflammatory markers, and specific ultrasonographic features are reliable predictors of difficult LC. Incorporating these factors into preoperative assessment can improve risk stratification, surgical planning, and patient outcomes.

Keywords: Gallstones, laparoscopic cholecystectomy, predictive factors, conversion, ultrasonography.

INTRODUCTION

Gallstone disease is one of the most common gastrointestinal disorders worldwide, with a prevalence ranging from 10% to 20% in the adult population[1]. Laparoscopic cholecystectomy (LC), first introduced in the late 1980s, has now become the gold standard treatment for symptomatic gallstones, owing to advantages such as less postoperative pain, shorter hospital stay, faster recovery, and better cosmesis when compared to open cholecystectomy[2].

Despite these advantages, LC is not always straightforward. In a subset of patients, the procedure becomes technically difficult, leading to prolonged operative time, increased intraoperative blood loss, bile duct injury, or even conversion to open surgery[3]. The reported conversion rate varies between 2–15%, depending on patient characteristics and disease severity[4].

Accurate preoperative prediction of difficulty is crucial. It allows for proper surgical planning, informed patient consent, allocation of experienced surgeons, and optimization of operative time[5]. Several predictors have been studied:

- Clinical factors: advanced age, male sex, obesity, recurrent attacks of cholecystitis, palpable gallbladder, and history of abdominal surgery[6].
- Laboratory factors: elevated total leukocyte count, raised alkaline phosphatase, deranged liver function tests, and increased amylase/lipase levels in gallstone pancreatitis[7].

- Radiological factors: gallbladder wall thickness >3 mm, pericholecystic fluid, contracted or distended gallbladder, and impacted stone at the neck/cystic duct are recognized as important sonographic markers [8].

Several scoring systems, including those proposed by Vivek et al., Nassar et al., and Sugrue et al., have been developed to predict difficult LC [5,9,10]. However, their accuracy may vary across populations and institutions, necessitating regional validation.

The present study was undertaken to evaluate the clinico-radiological and laboratory factors that predict difficult laparoscopic cholecystectomy, in order to improve preoperative risk assessment and surgical outcomes.

MATERIAL AND METHODS

Study Design and Duration

This was a **prospective observational study** conducted in the Department of General Surgery at the Integral Institute of Medical Sciences and Research, Lucknow, over 15 months (**January 2024 to March 2025**).

Sample Size

A total of **120 patients** fulfilling the inclusion criteria were included in the study.

Inclusion Criteria

1. All patients presenting with gallbladder stones.
2. Patients showing features of **cholelithiasis on ultrasonography (USG)**.

Exclusion Criteria

1. Patients with choledocholithiasis.
2. Suspected or proven gallbladder malignancy.
3. Deranged liver function tests.
4. Liver malignancy.
5. Immunocompromised patients.
6. Gallbladder polyps.
7. Pregnant females.
8. Patients with an **ASA score ≥ 4** .

Methodology

- After obtaining **informed written consent**, a detailed history was recorded, and all patients underwent general physical as well as local examination.
- Relevant clinical parameters were noted, including age, sex, BMI, duration of symptoms, and past surgical history.
- Routine hematological and biochemical investigations were performed.

Laboratory Investigations;

The following laboratory parameters were included in the evaluation:

1. **Complete Blood Count (CBC)** – Hemoglobin, TLC, DLC, Platelet count.
2. **Liver Function Tests (LFTs):**
 - Serum bilirubin (total and direct)
 - AST, ALT
 - Alkaline phosphatase (ALP)
 - Serum albumin, total protein
3. **Renal Function Tests (RFTs):** Blood urea, serum creatinine.
4. **Serum Amylase and Serum Lipase** – to rule out gallstone-induced pancreatitis.
5. **Lipid Profile:**
 - Total cholesterol
 - Triglycerides
 - LDL-C, HDL-C, VLDL-C
6. **Random blood sugar / Fasting blood glucose** – to assess metabolic status.
7. **Coagulation profile (PT/INR)** – to assess bleeding risk preoperatively.

Radiological assessment was done by ultrasonography (USG), evaluating:

- Gallbladder wall thickness
- Contracted/distended gallbladder
- Pericholecystic fluid collection
- Impacted stone at neck/cystic duct

- Number and size of stones

Scoring System

Patients were categorized into **easy, difficult, and very difficult laparoscopic cholecystectomy** groups using a clinico-radiological scoring system based on:

- Clinical factors (history, BMI, abdominal tenderness, palpable gallbladder, previous surgery, etc.)
- Sonographic factors (wall thickness, pericholecystic collection, impacted stone, gallbladder morphology, etc.).

Operative Evaluation

During surgery, intraoperative findings were recorded, including:

- Adhesions at Calot's triangle.
- Difficulty in gallbladder grasping/dissection.
- Bleeding during dissection.
- Bile/stone spillage.
- Conversion to open cholecystectomy.
- Operative time.

Study Outcomes

- **Primary outcome:** Correlation of preoperative clinico-radiological factors with intraoperative difficulty.
- **Secondary outcomes:** Rate of conversion to open surgery, intraoperative complications, and operative duration.

Statistical Analysis

All data were compiled in **Microsoft Excel** and analyzed using **SPSS software version 21**.

- Quantitative variables were expressed as **mean $\pm$ SD** and compared using the **Student's t-test**.
- Categorical variables were presented as percentages and compared using the **Chi-square test/Fisher's exact test**.
- A **p-value < 0.05** was considered statistically significant.

RESULTS AND OBSERVATIONS

A total of **120 patients** undergoing laparoscopic cholecystectomy were studied at the Department of General Surgery, Integral Institute of Medical Sciences and Research, Lucknow.

Table 1: Age-wise Distribution of Patients (n = 120)

Age group (years)	Number of patients	Percentage (%)
< 30	12	10.0
31–40	34	28.3
41–50	40	33.4
51–60	22	18.3
> 60	12	10.0

Mean age = 44.2 ± 11.8 years

Table 2: Gender Distribution

Gender	Number of patients	Percentage (%)
Male	36	30.0
Female	84	70.0

Female-to-male ratio = **2.3 : 1**

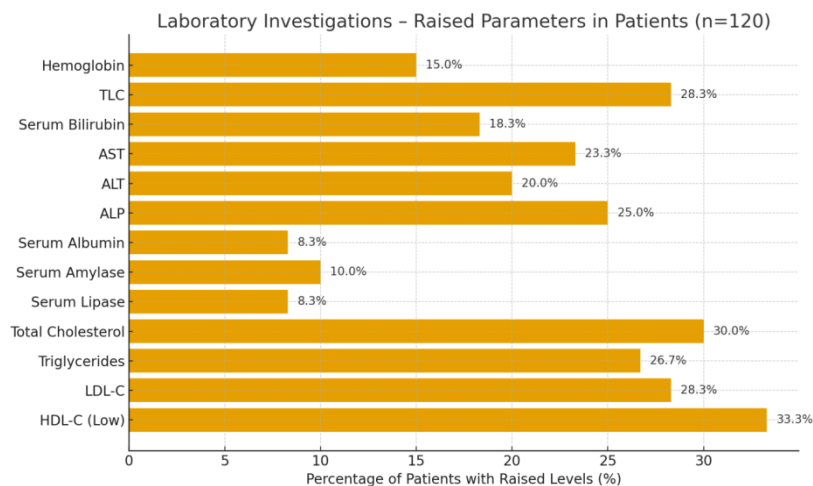
Table 3: Clinical Factors

Clinical Parameter	Number of patients	Percentage (%)
BMI ≥ 25 kg/m ² (overweight/obese)	50	41.7
History of recurrent cholecystitis	42	35.0
Previous abdominal surgery	10	8.3
Palpable gallbladder	18	15.0

Table 4: Laboratory Investigations

Parameter	Mean $\pm$ SD	Raised in n (%)
Hemoglobin (g/dL)	12.3 ± 1.5	18 (15.0)

Total Leukocyte Count (/mm ³)	9,620 ± 2,150	34 (28.3)
Serum Bilirubin (mg/dL)	1.0 ± 0.5	22 (18.3)
AST (U/L)	40 ± 14	28 (23.3)
ALT (U/L)	42 ± 16	24 (20.0)
ALP (U/L)	138 ± 36	30 (25.0)
Serum Albumin (g/dL)	3.9 ± 0.4	10 (8.3)
Serum Amylase (U/L)	84 ± 28	12 (10.0)
Serum Lipase (U/L)	90 ± 30	10 (8.3)
Total Cholesterol (mg/dL)	210 ± 40	36 (30.0)
Triglycerides (mg/dL)	170 ± 44	32 (26.7)
LDL-C (mg/dL)	128 ± 30	34 (28.3)
HDL-C (mg/dL)	40 ± 8	40 (33.3 low)



Figure; 1 Laboratory Investigations

Table 5: Radiological Findings (USG)

Radiological Feature	Number of patients	Percentage (%)
Gallbladder wall thickness > 3 mm	38	31.7
Contracted gallbladder	24	20.0
Distended gallbladder	14	11.7
Pericholecystic fluid	12	10.0
Impacted stone at neck/cystic duct	22	18.3
Multiple gallstones	70	58.3

Table 6: Operative Findings

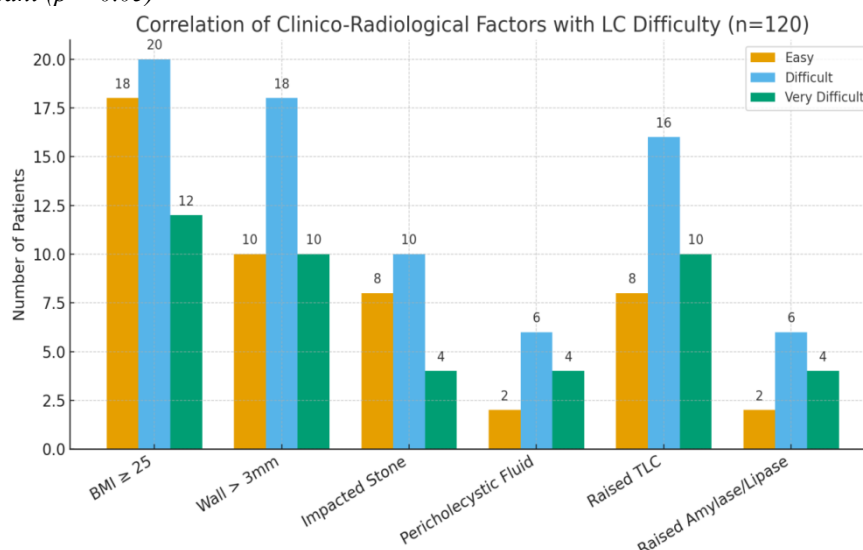
Operative Parameter	Number of patients	Percentage (%)
Easy dissection	72	60.0
Difficult dissection	34	28.3
Very difficult dissection	14	11.7
Adhesions at Calot's triangle	28	23.3
Bile/stone spillage	18	15.0
Intraoperative bleeding	10	8.3
Conversion to open cholecystectomy	8	6.7

Mean operative time = 72 ± 16 minutes

Table 7: Correlation of Clinico-Radiological Factors with Difficulty (n = 120)

Factor	Easy (n=72)	Difficult (n=34)	Very Difficult (n=14)	p-value
BMI ≥ 25 kg/m ²	18	20	12	0.001*
Gallbladder wall thickness > 3 mm	10	18	10	0.000*
Impacted stone	8	10	4	0.04*
Pericholecystic fluid	2	6	4	0.03*
Raised TLC	8	16	10	0.001*
Raised Serum Amylase/Lipase	2	6	4	0.05

Statistically significant ($p < 0.05$)



Figure; 2 Correlation of Clinico-Radiological Factors with Difficulty (n = 120)

DISCUSSION

Laparoscopic cholecystectomy (LC) is the treatment of choice for symptomatic gallstone disease and has largely replaced open cholecystectomy worldwide[1]. Although LC is considered safe and effective, some cases remain technically challenging due to anatomical distortion, severe inflammation, or adhesions. Such “difficult LC” is associated with prolonged operative time, higher complication rates, and increased conversion to open surgery[2]. Identifying predictive factors preoperatively is therefore essential for risk stratification, patient counselling, and surgical planning[3].

Age and Gender

In the present study, the mean age of patients was 44.2 years, with most cases occurring between 31–50 years. Increasing age has been reported as a predictor of difficulty, attributed to chronic inflammation, fibrosis, and comorbidities[4]. Our findings are consistent with Brunt et al., who observed higher difficulty in elderly patients[5].

Although females (70%) predominated in our study, reflecting the natural epidemiology of gallstone disease, difficult and very difficult cases were relatively more frequent in males. Similar findings have been reported by Zisman et al., who identified male gender as an independent predictor for conversion to open surgery[6].

Clinical Factors

Obesity (BMI ≥ 25 kg/m²) was present in 41.7% of our patients and showed a significant correlation with difficulty. Obesity complicates trocar placement, exposure of Calot’s triangle, and dissection, findings also supported by Vivek et al.[7].

Recurrent cholecystitis was reported in 35% of patients and was strongly associated with intraoperative difficulty due to dense adhesions. Nidoni et al. and Nachnani et al. similarly identified recurrent attacks as a reliable predictor[8,9]. Previous abdominal surgery was present in 8.3% but was not a major predictor in our series, unlike other reports where dense adhesions from prior surgery led to increased conversion rates[10].

Laboratory Parameters

In our cohort, 28.3% had raised total leukocyte count and 25% had elevated alkaline phosphatase, both significantly associated with difficult LC. These findings indicate ongoing inflammation or cholestasis and corroborate the results of Jina et al., who demonstrated that elevated TLC and LFT abnormalities were strong predictors[11]. Elevated serum amylase/lipase was noted in ~10% of cases, suggesting gallstone pancreatitis; these cases had longer operative times and more difficult dissection, in agreement with the study by Dhanke et al.[12]. Dyslipidemia (raised cholesterol and triglycerides, low HDL) was common but did not show a consistent correlation with intraoperative difficulty, similar to observations by Di Buono et al.[2].

Radiological Parameters

Ultrasonography remains the cornerstone of preoperative assessment. In our study, gallbladder wall thickness >3 mm (31.7%), impacted stone at the neck (18.3%), and pericholecystic fluid (10%) were significantly associated with difficult LC. Wall thickening indicates chronic cholecystitis, while impacted stones and pericholecystic collection suggest acute inflammation; all of these make dissection challenging. Similar associations have been documented by Sharma et al.[13]

and Gupta et al.[14]. Multiple gallstones (58.3%) were common but not significantly correlated with difficulty, consistent with Nidoni et al.[8].

Operative Findings and Conversion

Intraoperative assessment showed that **28.3% were difficult** and **11.7% were very difficult** cases, while the conversion rate was **6.7%**. These findings align with global reports of 5–10% conversion[6,14]. Adhesions at Calot's triangle and bleeding during dissection were the most frequent intraoperative challenges. Our findings are in line with Sugrue et al., who highlighted adhesions and unclear anatomy as the primary determinants of difficulty[15].

Comparison with Scoring Systems

Several predictive scoring systems exist. Vivek et al. proposed a clinico-radiological scoring method incorporating BMI, recurrent cholecystitis, wall thickness, and impacted stones[7]. Sugrue et al. developed an intraoperative grading system for assessing difficulty[15], while Nassar et al. created a preoperative scoring tool[16]. Our results support these predictors, especially gallbladder wall thickness, obesity, recurrent cholecystitis, and impacted stones, reinforcing the validity of these scoring systems in an Indian population.

CONCLUSION

Obesity, recurrent cholecystitis, raised total leukocyte count, gallbladder wall thickness >3 mm, impacted neck stone, and pericholecystic fluid were significant predictors of difficult laparoscopic cholecystectomy. Preoperative assessment using these clinico-radiological factors enables better risk stratification, surgical planning, and reduced conversion and complication rates.

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