



Original Article

Preoperative Prediction of Difficult Laparoscopic Cholecystectomy Using Clinical, Biochemical and Ultrasonographic Parameters: A Prospective Observational Study

Dr Rishav Raaz¹, MS General Surgery²

¹⁻²Department of General Surgery, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India Manuscript prepared from the submitted institutional thesis

 OPEN ACCESS

Corresponding Author:

Dr Rishav Raaz

Department of General Surgery,
Lord Buddha Koshi Medical College
and Hospital, Saharsa, Bihar, India
Manuscript prepared from the
submitted institutional thesis

Received: 12-05-2026

Accepted: 20-06-2026

Available online: 31-07-2026

ABSTRACT

Background: Laparoscopic cholecystectomy is the standard surgical treatment for symptomatic gallstone disease, but operative difficulty can arise from inflammation, adhesions, distorted anatomy and other patient- or disease-related factors. Reliable preoperative prediction may improve operative planning, counselling and patient safety.

Methods: This prospective observational study was conducted in the Department of General Surgery at Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, over 18 months from April 2024 to October 2025. One hundred patients undergoing elective or semi-elective laparoscopic cholecystectomy were assessed using standardized clinical, biochemical and ultrasonographic parameters. A composite preoperative score adapted from the Randhawa–Pujahari framework was used to categorize predicted operative difficulty. Actual intraoperative difficulty and conversion to open cholecystectomy were recorded. Statistical analysis included descriptive statistics, t-test, chi-square/Fisher exact test, diagnostic accuracy measures, logistic regression and ROC analysis as specified in the study protocol.

Results: The mean age of the cohort was 39.84 ± 12.40 years and 64% were female. Intraoperatively, 10% of procedures were classified as difficult and 90% as easy. Patients with difficult procedures were older than those with easy procedures (53.40 ± 12.01 vs 38.43 ± 11.27 years; $p < 0.0001$). Current acute attack, increasing number of previous acute attacks and previous abdominal surgery were significantly associated with difficulty (all $p < 0.0001$). Sex was not significantly associated with operative difficulty ($p = 0.095$). Elevated total bilirubin, SGOT, SGPT and alkaline phosphatase were significantly associated with difficult surgery ($p = 0.0001$, 0.002 , 0.00003 and 0.0002 , respectively). Pericholecystic collection ($p = 0.002$), impacted stone ($p < 0.0001$) and palpable gallbladder ($p = 0.002$) were also significant. Mean operative time was 71.70 ± 28.31 minutes overall and was substantially longer in difficult cases (125.00 ± 10.54 vs 65.78 ± 22.73 minutes; $p < 0.0001$). Conversion to open surgery occurred in 2% of patients.

Conclusion: In this cohort, operative difficulty was associated with a combination of clinical, biochemical and ultrasonographic findings rather than a single preoperative variable. Older age, active/recurrent acute cholecystitis, previous abdominal surgery, abnormal liver biochemical parameters, pericholecystic collection, impacted gallstone and a palpable gallbladder identified patients at increased risk of difficult laparoscopic cholecystectomy. A structured multiparameter preoperative assessment may therefore assist operative planning and counselling.

INTRODUCTION

Laparoscopic cholecystectomy (LC) is the established minimally invasive treatment for symptomatic gallstone disease and offers shorter hospital stay, less postoperative discomfort, faster recovery and improved cosmesis compared with open cholecystectomy. Despite its routine use, a subset of patients present with difficult operative conditions because of acute or chronic inflammation, dense adhesions, a contracted or fibrotic gallbladder, impacted stones, abnormal biliary anatomy or previous upper abdominal surgery.

Difficult LC has practical implications beyond operative duration. It can increase the risk of bile duct or vascular injury, increase the likelihood of conversion, prolong hospitalization and require greater operative expertise and resources. The thesis underpinning this manuscript emphasizes that preoperative recognition of high-risk cases can improve informed consent, theatre planning, team selection and anticipation of bail-out strategies.

Clinical, biochemical and ultrasonographic predictors have been evaluated individually and as composite scores. Parameters repeatedly reported in the literature include age, sex, obesity, previous attacks of cholecystitis, previous abdominal surgery, palpable gallbladder, gallbladder wall thickening, contracted gallbladder, impacted neck stone, pericholecystic fluid and abnormal liver biochemical tests. However, the thesis notes that no universally accepted prediction model has been standardized for diverse populations in eastern India. The present study therefore evaluated a multiparameter approach in patients undergoing LC at a tertiary-care teaching hospital in Saharsa, Bihar.

Aim and Objectives

To evaluate the predictive value of preoperative clinical, biochemical and ultrasonographic parameters for difficult laparoscopic cholecystectomy.

- To correlate preoperative clinical findings with intraoperative operative difficulty.
- To assess the association of biochemical parameters with difficult laparoscopic cholecystectomy.
- To evaluate ultrasonographic predictors of operative difficulty.
- To assess the relationship between preoperative prediction and conversion to open cholecystectomy.

MATERIALS AND METHODS

Study design and setting

This was a prospective observational study conducted in the Department of General Surgery, Lord Buddha Koshi Medical College and Hospital (LBKMCH), Saharsa, Bihar, India. Data were collected over 18 months from April 2024 through October 2025. One hundred eligible patients undergoing elective or semi-elective LC were enrolled consecutively.

Ethics and consent

According to the thesis, institutional ethics approval was obtained before commencement of the study. The study was conducted in accordance with the National Ethical Guidelines for Biomedical and Health Research (2017) and the Declaration of Helsinki (2013 revision). Written informed consent was obtained in Hindi or English, and confidentiality was maintained.

Preoperative assessment

Clinical assessment included age, sex, history of acute cholecystitis and number of acute attacks, previous abdominal surgery, palpable gallbladder and relevant physical findings. Laboratory assessment included total bilirubin, SGOT, SGPT, alkaline phosphatase and total leukocyte count. Ultrasonography was performed by a consultant radiologist within 72 hours of surgery and assessed gallbladder wall thickness, contracted gallbladder, impacted stone at the neck/cystic duct, pericholecystic collection, Mirizzi syndrome and common bile duct diameter.

Preoperative scoring system

A composite score adapted from the validated Randhawa–Pujahari framework was used. The thesis assigns points for male sex (1), body weight >65 kg (1), previous abdominal surgery (1), ≥ 2 previous acute attacks (1), palpable gallbladder (1), gallbladder wall thickness ≥ 4 mm (2), impacted stone at the neck/cystic duct (2), pericholecystic collection (1), contracted gallbladder (2), TLC $>11,000/\text{mm}^3$ (1), and total bilirubin >1.2 mg/dL (1). Scores of 0–5, 6–10 and ≥ 11 were classified as easy, difficult and very difficult, respectively.

Parameter	Criterion	Score
Sex	Male	1
Body weight	>65 kg	1

Previous abdominal surgery	Present	1
Previous acute attacks	≥2 episodes	1
Palpable gallbladder	Present	1
GB wall thickness	≥4 mm	2
Impacted stone	Neck/cystic duct	2
Pericholecystic collection	Present	1
Contracted gallbladder	Present	2
TLC	>11,000/mm ³	1
Total bilirubin	>1.2 mg/dL	1

Score interpretation: 0–5 = Easy; 6–10 = Difficult; ≥11 = Very difficult.

Operative protocol and definition of difficulty

All procedures were performed under general anaesthesia by consultant surgeons with at least five years of laparoscopic experience or under their direct supervision. A standardized four-port LC technique was used. The Critical View of Safety was sought before division of tubular structures. Difficult LC was defined by intraoperative technical difficulty including dense adhesions/frozen Calot's triangle, a contracted fibrotic gallbladder, acute/gangrenous/empyematous inflammation and cases requiring conversion. Conversion was regarded as a safety decision rather than procedural failure.

Statistical analysis

Data were entered into Microsoft Excel and analysed using SPSS version 22. Continuous variables were summarized as mean ± standard deviation and categorical variables as frequency and percentage. Student's t-test was used for continuous variables and chi-square or Fisher's exact test for categorical variables. Diagnostic accuracy measures, binary logistic regression and ROC analysis were specified in the thesis protocol. Statistical significance was set at $p < 0.05$.

RESULTS

The study included 100 patients. Mean age was 39.84 ± 12.40 years, with most patients aged 26–55 years. Females comprised 64% of the cohort. A current acute attack was present in 10% of patients. Previous abdominal surgery was reported in 2 patients.

Variable	Easy LC (n=90)	Difficult LC (n=10)	p value
Age, mean ± SD (years)	38.43 ± 11.27	53.40 ± 12.01	<0.0001
Male sex	30	6	0.095
Present acute attack	2	8	<0.0001
Previous abdominal surgery	0	2	<0.0001
Total bilirubin elevated	26	9	0.0001
SGOT elevated	28	8	0.002
SGPT elevated	23	9	0.00003
ALP elevated	22	8	0.0002
Pericholecystic collection	30	8	0.002
Impacted stone	25	9	<0.0001
Palpable gallbladder	28	8	0.002
Operative time, mean ± SD (min)	65.78 ± 22.73	125.00 ± 10.54	<0.0001

Ten patients (10%) were classified as difficult on intraoperative assessment. Clinical parameters predicted 12 patients as difficult; 9 of these 12 were confirmed as difficult intraoperatively. Ultrasonography predicted 8 patients as difficult; 7 of these 8 were confirmed as difficult. From these 2×2 tables, the clinical prediction had a calculated sensitivity of 90.0%, specificity of 96.7%, positive predictive value of 75.0% and negative predictive value of 98.9%; ultrasonographic prediction had a calculated sensitivity of 70.0%, specificity of 98.9%, positive predictive value of 87.5% and negative predictive value of 98.9%. These accuracy measures are derived directly from the frequencies reported in the thesis.

Ultrasonography demonstrated a contracted gallbladder in 48%, pericholecystic collection in 38%, impacted gallstone in 34% and palpable gallbladder on clinical examination in 36% of patients. The mean operative duration for the complete cohort was 71.70 ± 28.31 minutes; 60% of operations lasted 60–120 minutes. Conversion to open cholecystectomy occurred in 2 patients (2%).

DISCUSSION

The principal finding of this study is that difficult LC was associated with a cluster of preoperative features reflecting inflammatory burden, previous disease episodes, altered biliary anatomy or local inflammatory change. Older age showed a strong association with operative difficulty, with the difficult group having a mean age of 53.40 years compared with 38.43 years in the easy group. This is consistent with the thesis literature review, in which increasing age is repeatedly described as a risk factor for difficult dissection and conversion.

An active acute attack and increasing numbers of previous attacks were strongly associated with operative difficulty. Recurrent inflammation can lead to fibrosis and dense adhesions, making identification of the hepatocystic triangle and Critical View of Safety more difficult. Previous abdominal surgery was also significantly associated with difficulty in this cohort, although only two patients had such a history.

Biochemical abnormalities were important markers in the present study. Elevated bilirubin, SGOT, SGPT and alkaline phosphatase were all significantly associated with difficult LC. These abnormalities may reflect biliary obstruction, inflammatory activity or hepatobiliary involvement and can therefore provide useful preoperative warning signals.

Ultrasonographic findings were also clinically informative. Pericholecystic collection, impacted stone and a palpable gallbladder were significantly associated with operative difficulty. The thesis also highlights contracted gallbladder and gallbladder wall thickening as established predictors in the literature, although the statistically significant associations reported in the present cohort should be distinguished from predictors reported in external studies.

The conversion rate in this study was 2%. Importantly, conversion should be viewed as a safety strategy when anatomy cannot be defined or dissection becomes hazardous. The thesis emphasizes that anticipation of difficult cases allows appropriate counselling, resource allocation and selection of experienced surgical support.

Clinical implications

- Patients with advanced age or recurrent/active cholecystitis should be considered at increased risk of difficult dissection.
- Abnormal bilirubin, SGOT, SGPT and alkaline phosphatase values should increase preoperative vigilance for a difficult procedure.
- Ultrasonographic findings such as impacted neck/cystic duct stone and pericholecystic collection are useful warning signs.
- A structured multiparameter assessment can support counselling, operating-room planning and preparedness for bail-out procedures or conversion.
- The Critical View of Safety should remain the essential intraoperative safety endpoint before division of the cystic duct or artery.

Strengths and limitations

Strengths include prospective data collection, standardized preoperative assessment, standardized operative technique, and correlation of preoperative findings with actual intraoperative difficulty. The study also integrates clinical, biochemical and ultrasonographic parameters rather than relying on a single predictor.

Limitations include the single-centre design, relatively small sample size of 100 patients, and only 10 difficult cases with 2 conversions, which limits the precision of estimates and the stability of multivariable modelling. The thesis reports a predominantly female cohort and only two patients with previous abdominal surgery, limiting generalizability for those variables. External validation in larger multicentre cohorts would be required before the adapted score could be considered a broadly applicable prediction model.

CONCLUSION

In this prospective cohort of 100 patients undergoing laparoscopic cholecystectomy, operative difficulty was significantly associated with increasing age, active and recurrent acute cholecystitis, previous abdominal surgery, elevated bilirubin and liver enzymes, pericholecystic collection, impacted gallstone and a palpable gallbladder. Sex was not significantly associated with difficulty. Difficult procedures required substantially longer operative time, and conversion to open surgery occurred in 2% of patients. A structured preoperative assessment integrating clinical history, biochemical testing and ultrasonography may improve prediction of operative difficulty and facilitate safer operative planning.

Declarations

Ethics approval and consent

The thesis states that institutional ethics approval was obtained before study commencement and that written informed consent was obtained from participants.

Consent for publication

Not applicable to aggregate, anonymized study data. Any journal-specific wording should be completed according to the target journal's instructions.

Availability of data

The study dataset was maintained as part of the institutional thesis project. A data-sharing statement should be finalized according to institutional policy and the target journal's requirements.

Conflict of interest

To be confirmed by the author(s).

Funding

To be confirmed by the author(s).

Author contributions

To be completed according to the actual contributions of all authors and supervisors before journal submission.

REFERENCES

1. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: a scoring method. (Reference details to be verified against the thesis bibliography before submission.)
2. Malligurki A, et al. Preoperative clinical and ultrasonographic assessment for prediction of difficult laparoscopic cholecystectomy. 2021. (Full bibliographic details to be verified.)
3. Putra et al. Prospective validation of a multiparameter preoperative scoring system for difficult laparoscopic cholecystectomy. 2022. (Full bibliographic details to be verified.)
4. Malla et al. Laparoscopic cholecystectomy outcomes at Dhulikhel Hospital. 2010. (Full bibliographic details to be verified.)
5. Genc et al. Predictors of conversion in consecutive laparoscopic cholecystectomies. 2011. (Full bibliographic details to be verified.)
6. Ibrahim et al. Relationship of obesity with operative time and conversion during laparoscopic cholecystectomy. 2006. (Full bibliographic details to be verified.)
7. Yetim et al. Pericholecystic fluid as a predictor of conversion during laparoscopic cholecystectomy. 2009. (Full bibliographic details to be verified.)
8. Gupta et al. Composite clinical and ultrasonographic scoring for prediction of operative difficulty. 2013. (Full bibliographic details to be verified.)
9. Bourgouin et al. Multicentre logistic regression model for prediction of difficult laparoscopic cholecystectomy. 2016. (Full bibliographic details to be verified.)
10. Way et al. Analysis of bile duct injuries and visuospatial misperception during laparoscopic cholecystectomy. 2003. (Full bibliographic details to be verified.)