



A PROSPECTIVE STUDY ON PREOPERATIVE PREDICTIVE FACTORS FOR DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY

Dr. Kusuma Rahul Deep

Senior Resident, Department of General Surgery, Maharajah's Institute of Medical Sciences, Nellimarla, Andhra Pradesh, India.

Dr. Susnigdha Kotaru*

Non-Pg Junior Resident, Department of General Surgery, Maharajah's Institute of Medical Sciences, Nellimarla, Andhra Pradesh, India.

*Corresponding Author

ABSTRACT

Background: Laparoscopic cholecystectomy (LC) is the standard treatment for gallstone disease. However, predicting surgical difficulty preoperatively remains a challenge. Identifying risk factors can help optimize patient management and improve outcomes. **Objective:** This study aims to evaluate specific demographic, clinical, biochemical, and radiological predictors of difficult LC. **Methods:** This prospective observational study included 50 patients undergoing LC at MIMS General Hospital between July 2022 and December 2023. Patients were assessed preoperatively for demographic characteristics, clinical presentation, laboratory findings, and imaging parameters. Intraoperative factors such as surgery duration, blood loss, and conversion to open surgery were recorded. Statistical analysis was conducted using SPSS, with a significance threshold of $p < 0.05$. **Results:** Older age (≥ 40 years, 72%), female gender (70%), and BMI > 30 ($p = 0.031$) were significantly associated with surgical difficulty. Gallbladder wall thickness > 4 mm correlated with prolonged surgery ($p = 0.0054$) and increased bleeding ($p = 0.002$) [1,2]. Elevated total leukocyte count ($> 11,000$) was linked to greater blood loss ($p = 0.0022$) and longer surgery duration ($p = 0.052$) [3,4]. Distended or contracted gallbladders were associated with increased bleeding ($p = 0.02$) [5]. In contrast, previous surgery, number of stones, and stone size did not significantly impact surgical difficulty [6]. **Conclusion:** Gallbladder wall thickness, BMI, and TLC are key predictors of difficult LC. Preoperative risk assessment incorporating these factors can improve patient outcomes and surgical planning.

KEYWORDS : Laparoscopic cholecystectomy, gallbladder disease, preoperative risk factors, surgical difficulty, predictive modelling.

INTRODUCTION

Laparoscopic cholecystectomy (LC) has revolutionized gallstone disease management, providing superior outcomes compared to open cholecystectomy. However, LC may be technically challenging due to patient-specific factors that increase surgical difficulty. Identifying reliable preoperative predictors can enhance surgical planning, reduce complications, and improve patient outcomes [7]. This study evaluates preoperative risk factors influencing LC difficulty, aiming to develop predictive models for risk stratification.

Methods

Study Design and Setting

This was a prospective observational study conducted at MIMS General Hospital from July 2022 to December 2023.

Participants

A total of 50 patients scheduled for LC were included. Inclusion criteria were patients aged 20-75 years with radiologically confirmed cholelithiasis. Exclusion criteria included obstructive jaundice, gallstone pancreatitis, gallbladder carcinoma, or contraindications for laparoscopic surgery.

Data Collection

Preoperative assessments included demographic details, clinical examination, laboratory investigations (total leukocyte count, liver function tests), and imaging studies (ultrasonography for gallbladder wall thickness, size, and stone characteristics). Intraoperative parameters recorded were duration of surgery, blood loss, surgeon's subjective assessment of difficulty, and conversion to open surgery.

Surgical Procedure

Laparoscopic cholecystectomy was performed under general anesthesia using a standard four-port technique.[Figure 1] [8]. A pneumoperitoneum was created using carbon dioxide insufflation. The gallbladder was visualized, adhesions were dissected, and the cystic duct and artery were identified, clipped, and divided[Figure 2]. The gallbladder was then detached from the liver bed and extracted through the

umbilical port[Figure 3]. In cases of dense adhesions or unclear anatomy, conversion to open cholecystectomy was considered. Intraoperative images illustrating key procedural steps and challenging cases are included for reference.



Figure 1: Port Position Of Cholecystectomy: [8]

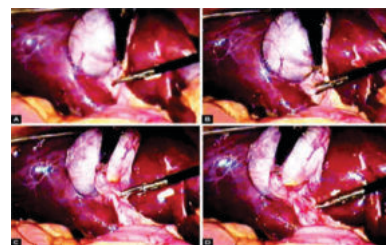


Figure 2: The Cystic Duct Is Separated From The Artery By Creating A Window

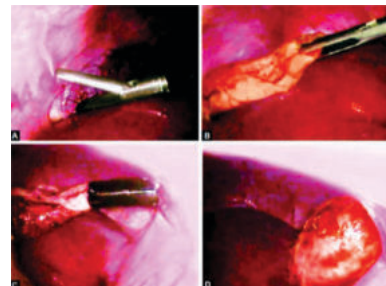


Figure 3: Extraction Of Gall Bladder

Statistical Analysis

Descriptive statistics were used to summarize patient characteristics. Independent t-tests and chi-square tests were applied to determine associations between preoperative factors and surgical difficulty. A p-value <0.05 was considered statistically significant.

RESULTS

Patient Demographics and Clinical Characteristics: Among the 50 patients, 72% were ≥40 years, and 70% were female. BMI >30 was significantly associated with surgical difficulty (p=0.031) [2]. History of previous abdominal surgery was noted in 32% of cases, though it was not statistically significant in predicting LC difficulty (p=0.363).

Preoperative Imaging and Laboratory Findings: [Table 1 , Figure 4]

- Gallbladder Wall Thickness: 30% had wall thickness >4mm, which was significantly associated with longer surgery (p=0.0054) and higher intraoperative bleeding (p=0.002) [3].
- Total Leukocyte Count (TLC): 12% had TLC >11,000, which correlated with increased bleeding (p=0.0022) and prolonged surgery (p=0.052) [4,5].
- Gallbladder Size: Distended or contracted gallbladders were linked to increased intraoperative bleeding (p=0.02) [6].
- Number and Size of Stones: 80% had multiple stones, and 16% had stones >1cm. However, these factors did not significantly affect surgical difficulty [7].

Intraoperative Outcomes:

[Table 2, Figure 6]

- Surgical Duration: 32% of procedures lasted >120 minutes, significantly associated with gallbladder wall thickness and elevated TLC [2,4].
- Blood Loss: 12% experienced moderate blood loss, correlating with gallbladder size abnormalities and elevated TLC [3].

Surgeon's Subjective Assessment:

[Table 3, Figure 3]

20% of cases were deemed "difficult" by the operating surgeon, with strong associations observed with BMI >30 and gallbladder wall thickness >4mm [6].

Table 1:association Between Duration Of Surgery And Pre-operative Parameters.

DURATION OF SURGERY		>120 MIN	<120 MIN	P- VALUE
AGE	< 40	6	8	0.304
	> 40	10	26	
GENDER	MALE	6	9	0.427
	FEMALE	10	25	
BMI	> 30	6	6	0.125
	< 30	10	28	
SYMPTOMS	PRESENT	13	23	0.317
	ABSENT	3	11	
PREVIOUS SURGERY	YES	4	12	0.466
	NO	12	22	
TLC	> 11000	4	2	0.052
	< 11000	12	32	
NO. OF STONES	SOLITARY	2	8	0.363
	MULTIPLE	14	26	
SIZE OF STONE	> 1 CM	2	6	0.643
	< 1 CM	14	28	
GALL BLADDER SIZE	NORMAL	12	31	0.274
	DISTENDED	2	1	
GALL BLADDER WALL THICKNESS	CONTRACTED	2	2	0.0054
	> 4 MM	9	6	
	< 4 MM	7	28	



Figure 4: Cluster Bar Chart Of The Association Between Duration Of Surgery And Pre-operative Parameters

Table 2: Association Between Intra-operative Bleeding And Pre-operative Parameters

DURATION OF SURGERY		MILD	MODERATE	P-VALUE
AGE	< 40	13	1	0.509
	> 40	31	5	
GENDER	MALE	12	3	0.254
	FEMALE	32	3	
BMI	> 30	10	2	0.568
	< 30	34	4	
SYMPTOMS	PRESENT	31	5	0.509
	ABSENT	13	1	
PREVIOUS SURGERY	YES	14	2	0.94
	NO	30	4	
TLC	> 11000	3	3	0.0022
	< 11000	41	3	
NO. OF STONES	SOLITARY	9	1	0.827
	MULTIPLE	35	5	
SIZE OF STONE	> 1 CM	6	2	0.216
	< 1 CM	38	4	
GALL BLADDER SIZE	NORMAL	40	3	0.02
	DISTENDED	2	1	
GALL BLADDER WALL THICKNESS	CONTRACTED	2	2	0.002
	> 4 MM	10	5	
	< 4 MM	34	1	



Figure 5: Cluster Bar Chart Of The Association Between Intra-operative Blood Loss And Pre-operative Parameters.

Table 3: Association Between Surgeons Inference And Pre-operative Parameters:

SURGEONS INFERENCE		EASY	DIFFICULT	P- VALUE
AGE	< 40	9	5	0.083
	> 40	31	5	
GENDER	MALE	12	3	0.699
	FEMALE	28	7	
BMI	> 30	7	5	0.031
	< 30	33	5	
SYMPTOMS	PRESENT	27	9	0.156
	ABSENT	13	1	
PREVIOUS SURGERY	YES	14	2	0.363
	NO	26	8	
TLC	> 11000	4	2	9.384
	< 11000	36	8	
NO. OF STONES	SOLITARY	8	2	0.658
	MULTIPLE	32	8	
SIZE OF STONE	> 1 CM	7	1	0.562
	< 1 CM	33	9	

GALL BLADDER SIZE	NORMAL	36	7	0.228
	DISTENDED	2	1	
	CONTRACTED	2	2	
GALL BLADDER WALL THICKNESS	> 4 MM	10	5	0.122
	< 4 MM	30	5	



Figure 6: Cluster Bar Chart Of The Association Between Surgeon's Inference And Pre-operative Parameters.

DISCUSSION

Our study highlights three key preoperative factors—gallbladder wall thickness, BMI, and total leukocyte count (TLC)—as significant predictors of difficult LC. These findings reinforce prior studies emphasizing the role of anatomical and inflammatory changes in determining surgical complexity [1,3]. Gallbladder wall thickness emerged as the strongest predictor, with increased thickness (>4mm) correlating with prolonged surgical time and increased intraoperative bleeding. This aligns with findings from previous studies that suggest chronic inflammation leads to fibrotic changes and adhesions, making dissection challenging [4]. Given this, preoperative ultrasonography should play a critical role in assessing the feasibility of LC. Elevated BMI was another significant factor, with obese patients (>30 BMI) more likely to experience intraoperative difficulties. Increased visceral fat can obscure the surgical field, prolonging operative time and increasing the risk of complications. This finding underscores the importance of weight optimization strategies in elective surgical patients [6]. Elevated TLC (>11,000) was associated with prolonged surgery and increased blood loss, suggesting an underlying inflammatory state. Patients presenting with acute cholecystitis or subclinical infection should be closely monitored, and preoperative optimization (e.g., antibiotics, interval surgery after inflammation subsides) should be considered to mitigate risks [5]. Interestingly, the number and size of gallstones were not significant predictors of surgical difficulty. This contradicts common assumptions that larger or multiple stones complicate the procedure. Instead, anatomical factors such as gallbladder wall characteristics and pericholecystic inflammation appear to play a more substantial role in operative complexity [7]. Our study's limitations include a small sample size and single-center design, which may limit generalizability. Future multicenter studies with larger cohorts are needed to refine predictive models and develop standardized risk scoring systems for difficult LC [9].

CONCLUSION

This study underscores the importance of preoperative assessment in predicting difficult laparoscopic cholecystectomy. Gallbladder wall thickness, BMI, and total leukocyte count emerged as the most significant predictors of surgical difficulty. By incorporating these factors into routine surgical evaluation, clinicians can improve patient selection, optimize resource allocation, and enhance intraoperative preparedness. Furthermore, these findings support the development of standardized risk assessment tools to improve clinical decision-making. Future research should focus on larger, multicenter trials to validate these predictors

and refine preoperative scoring systems for widespread clinical adoption.

REFERENCES

1. Lattoo MR, Gupta S, Ahmad Y, et al. External Validity of Preoperative Predictive Risk Scoring System for Assessment of Difficulty in Laparoscopic Cholecystectomy at a Rural Hospital. *World J Lap Surg* 2023;16(3):129–132.
2. Santharaj S, Marahanumaiah S. Pre-operative predictors of difficult laparoscopic cholecystectomy: a comparative study between two scoring systems. *International Surgery Journal*. 2022 Apr 26;9(5):960.
3. ABD EL-RAHMAN F.E. DARWISH, Abd El-Banna and Abd Salem. assessment of perioperative predictors of difficult laparoscopic cholecystectomy. *Al-Azhar Medical Journal*. 2022 Jan 1;51(1):13–30
4. Hassan AM. Preoperative predictive risk factors of difficult laparoscopic cholecystectomy. *The Egyptian Journal of Surgery*, April-June 2021. 40(2). 536–543
5. Di Buono G, Romano G, Galia M, Amato G, Maienza E, Vernuccio F, et al. Difficult laparoscopic cholecystectomy and preoperative predictive factors. *Scientific Reports [Internet]*. 2021 Jan 28;11(1).
6. Agrawal N, Singh S, Khichy S. Preoperative prediction of difficult laparoscopic cholecystectomy: A scoring method. *Niger J Surg* 2015;21:130-3.
7. Stoica PL, Serban D, Bratu DG, Serboiu CS, Costea DO, Tribus LC, et al. Predictive Factors for Difficult Laparoscopic Cholecystectomies in Acute Cholecystitis. *Diagnostics [Internet]*. 2024 Jan 1 [cited 2024 May 26];14(3):346.
8. Mishra DRK. Laparoscopic Cholecystectomy Operative Technique [Internet]. *www.laparoscopyhospital.com*. Available from: <https://www.laparoscopyhospital.com/iranianmedicaluniversity.htm>
9. Elgammal AS, Elmehligi MH, Koura MMA. Evaluation of preoperative predictive factors for difficult laparoscopic cholecystectomy. *International Surgery Journal*. 2019 Aug 28;6(9):3052.