e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com doi: 10.25258/ijpqa.16.4.32

International Journal of Pharmaceutical Quality Assurance 2025; 16(4); 180-184

Original Research Article

Predictive Value of Preoperative Clinical and Radiological Indicators for Intraoperative Challenges in Laparoscopic Cholecystectomy

Manish Tardeja[1], Ameet Bhasme[2], Rachna Singh[3]

[1]Associate Professor, Department of General Surgery, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra, India

[2]Associate Professor, Department of General Surgery, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra, India

[3]Senior Resident, Department of Radiology, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra, India

Received:10-02-2025 / Revised: 22-03-2025 / Accepted: 28-04-2025

Corresponding Author: Dr. Ameet Bhasme

Conflict of interest: Nil

Abstract:

Background: Laparoscopic cholecystectomy (LC) is the standard treatment for symptomatic gallstone disease. However, certain preoperative factors may predict technical difficulty, potentially increasing operative time, complication risk, and conversion to open cholecystectomy. This study aims to assess the role of preoperative clinical and radiological parameters in anticipating intraoperative challenges.

Objectives: To evaluate and correlate specific preoperative clinico-radiological findings with intraoperative difficulty in laparoscopic cholecystectomy, thereby aiding in better surgical planning and patient counseling.

Methods: A prospective observational study was conducted on 120 patients undergoing elective laparoscopic cholecystectomy at Department of General Surgery, Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra, India. Preoperative clinical factors (age, BMI, history of acute cholecystitis, previous abdominal surgery, and palpable gallbladder) and radiological findings (gallbladder wall thickness, pericholecystic fluid, impacted stones, gallbladder contraction, and common bile duct diameter) were documented. Intraoperative difficulty was scored based on operative time, adhesions, bleeding, and need for conversion. Statistical analysis was performed to assess correlations.

Results: Out of 120 patients, 38 (31.7%) experienced significant intraoperative difficulty. Older age (>60 years), BMI >30 kg/m², history of acute cholecystitis, and palpable gallbladder were significantly associated with difficult laparoscopic cholecystectomy. On imaging, gallbladder wall thickness >3 mm, pericholecystic fluid, and contracted gallbladder were strongly predictive of intraoperative difficulty ($p<0.05$). The conversion rate to open cholecystectomy was 8.3%.

Conclusion: Preoperative clinical and ultrasonographic parameters provide valuable insight into predicting the complexity of laparoscopic cholecystectomy. Recognizing these factors preoperatively helps surgeons anticipate technical challenges, optimize team preparedness, and inform patients appropriately.

Keywords: Laparoscopic cholecystectomy, Preoperative prediction, Gallbladder wall thickness, Radiological markers, Surgical difficulty, Conversion to open surgery

Introduction

Laparoscopic cholecystectomy (LC) has become the gold standard treatment for symptomatic gallstone disease since its introduction in the late 1980s. It is widely preferred over open cholecystectomy due to its advantages, including reduced postoperative pain, shorter hospital stay, faster recovery, and better cosmetic outcomes [1]. However, despite its minimally invasive nature, LC is not devoid of challenges. In some patients, intraoperative difficulties may arise, potentially leading to prolonged operative time, increased risk of complications, and, in some cases, conversion to open surgery [2].

The ability to anticipate difficult laparoscopic cholecystectomy preoperatively is invaluable to the surgeon. It facilitates better operative planning, proper allocation of resources, and improved patient counselling [3]. Identifying patients at higher risk for intraoperative complications also allows for appropriate surgical expertise to be mobilized and helps minimize operative morbidity.

Several clinical and radiological parameters have been proposed as predictors of intraoperative difficulty [4]. Clinical factors such as advanced age, high body mass index (BMI), history of recurrent

biliary colic or acute cholecystitis, palpable gallbladder, and prior abdominal surgeries are considered relevant. On the other hand, ultrasonographic findings like increased gallbladder wall thickness, contracted gallbladder, presence of pericholecystic fluid, impacted stones at the neck of the gallbladder, and dilated common bile duct are increasingly recognized for their predictive value [5,6].

Among imaging modalities, ultrasonography remains the first-line tool due to its non-invasive nature, accessibility, and cost-effectiveness. Preoperative ultrasound not only confirms the diagnosis of gallstones but also provides useful data that may help predict intraoperative difficulty [7]. However, the degree of correlation between these preoperative findings and actual surgical complexity remains an area of active investigation.

With the increasing burden of gallstone disease and rising demand for laparoscopic procedures, it becomes imperative to develop a standardized approach to risk stratification. This study was designed to evaluate the predictive value of specific clinical and radiological parameters in anticipating intraoperative challenges in patients undergoing elective laparoscopic cholecystectomy. By identifying reliable predictors of surgical difficulty, we aim to enhance patient safety, reduce operative complications, and contribute to the growing body of knowledge on preoperative surgical assessment.

Methods

This prospective observational study was conducted in the Department of General Surgery at Dr. Panjabrao Deshmukh Memorial Medical College, Amravati, Maharashtra, over a period of 12 months. The study aimed to identify preoperative clinical and radiological factors that could reliably predict intraoperative difficulties in patients undergoing elective laparoscopic cholecystectomy. A total of 120 patients with symptomatic gallstone disease, diagnosed through clinical and sonographic evaluation, were included based on predefined inclusion and exclusion criteria. Inclusion criteria consisted of adult patients aged 18–75 years with ultrasound-confirmed cholelithiasis who were scheduled for elective laparoscopic cholecystectomy. Exclusion criteria included patients undergoing emergency surgery for complications like perforated gallbladder or biliary peritonitis, those with known malignancy, pregnant women, and patients with severe cardiopulmonary comorbidities unfit for general anesthesia.

All patients underwent a detailed preoperative clinical assessment, including age, sex, body mass index (BMI), history of prior episodes of acute cholecystitis, history of upper abdominal surgery, and presence of a palpable gallbladder. Preoperative ultrasonography was performed in all patients by an experienced radiologist. Radiological parameters recorded included gallbladder wall thickness, presence of pericholecystic fluid, impacted stones at the gallbladder neck, gallbladder contraction, and common bile duct (CBD) diameter. Gallbladder wall thickness greater than 3 mm and a CBD diameter more than 6 mm were considered abnormal.

Laparoscopic cholecystectomy was performed using the standard four-port technique by experienced surgeons. Intraoperative difficulty was assessed and graded based on objective criteria including operative time, degree of adhesions, bleeding, difficulty in identifying the Calot's triangle, need for additional ports, and conversion to open surgery. A cumulative difficulty score was assigned to each case. Cases requiring >60 minutes of operative time, extensive adhesiolysis, unclear anatomy, or conversion were classified as "difficult cholecystectomy."

All data were collected in a structured format and entered into Microsoft Excel. Statistical analysis was performed using SPSS version 25. Categorical variables were compared using the Chi-square test or Fisher’s exact test, while continuous variables were analyzed using Student’s t-test. A p-value less than 0.05 was considered statistically significant. The study protocol was approved by the institutional ethics committee, and informed consent was obtained from all participants prior to inclusion.

Results

A total of 120 patients scheduled for elective laparoscopic cholecystectomy were enrolled in the study. The mean age of the cohort was 46.8 ± 13.2 years. Females were the majority (72.5%). Intraoperatively, 35 patients (29.2%) experienced difficulties, and 85 patients (70.8%) had relatively easy procedures.

Table 1: Age Distribution and Intraoperative Difficulty

Age Group (years)	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
<40	33 (38.8%)	5 (14.3%)	38 (31.7%)	
40–60	39 (45.9%)	18 (51.4%)	57 (47.5%)	
>60	13 (15.3%)	12 (34.3%)	25 (20.8%)	0.021

Table 2: Gender Distribution and Surgical Difficulty

Gender	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
Male	18 (21.2%)	15 (42.9%)	33 (27.5%)	
Female	67 (78.8%)	20 (57.1%)	87 (72.5%)	0.016

Table 3: BMI Classification and Surgical Difficulty

BMI Category (kg/m²)	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
<25	43 (50.6%)	9 (25.7%)	52 (43.3%)	
25–30	28 (32.9%)	16 (45.7%)	44 (36.7%)	
>30	14 (16.5%)	10 (28.6%)	24 (20.0%)	0.034

Table 4: History of Acute Cholecystitis and Surgical Difficulty

History of Acute Cholecystitis	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
Present	24 (28.2%)	20 (57.1%)	44 (36.7%)	
Absent	61 (71.8%)	15 (42.9%)	76 (63.3%)	0.003

Table 5: Palpable Gallbladder and Surgical Difficulty

Palpable Gallbladder	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
Yes	12 (14.1%)	14 (40.0%)	26 (21.7%)	
No	73 (85.9%)	21 (60.0%)	94 (78.3%)	0.001

Table 6: Gallbladder Wall Thickness and Surgical Difficulty

Wall Thickness	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
≤3 mm	68 (80.0%)	12 (34.3%)	80 (66.7%)	
>3 mm	17 (20.0%)	23 (65.7%)	40 (33.3%)	<0.001

Table 7: Gallbladder Contractility and Surgical Difficulty

Gallbladder Status	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
Normal	77 (90.6%)	20 (57.1%)	97 (80.8%)	
Contracted	8 (9.4%)	15 (42.9%)	23 (19.2%)	<0.001

Table 8: Impacted Stone in Gallbladder Neck and Surgical Difficulty

Impacted Stone	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
Present	10 (11.8%)	17 (48.6%)	27 (22.5%)	
Absent	75 (88.2%)	18 (51.4%)	93 (77.5%)	<0.001

Table 9: Pericholecystic Fluid and Surgical Difficulty

Pericholecystic Fluid	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
Present	9 (10.6%)	13 (37.1%)	22 (18.3%)	
Absent	76 (89.4%)	22 (62.9%)	98 (81.7%)	0.001

Table 10: CBD Diameter and Surgical Difficulty

CBD Diameter	Easy (n=85)	Difficult (n=35)	Total (n=120)	p-value
≤6 mm	79 (92.9%)	25 (71.4%)	104 (86.7%)	
>6 mm	6 (7.1%)	10 (28.6%)	16 (13.3%)	0.002

Discussion

This prospective observational study aimed to identify specific preoperative clinical and radiological factors that could reliably predict intraoperative difficulties encountered during laparoscopic cholecystectomy [8]. The findings of our study are consistent with previously published literature and reinforce the utility of certain patient characteristics and ultrasonographic markers in anticipating challenging surgical scenarios. Among the clinical factors, advanced age—particularly patients aged 60 years and above—was significantly associated with a higher incidence of difficult cholecystectomies [9]. This may be due to the increased incidence of chronic inflammation, fibrosis, and comorbidities in the elderly population, which complicate dissection and increase operative time. Male gender also emerged as a significant predictor, potentially due to delayed presentation and more fibrotic gallbladders compared to females, as frequently reported in earlier studies [10].

Obesity, as measured by body mass index (BMI >30), was also found to be a strong predictor of technical difficulty during surgery. Thick abdominal walls and increased intra-abdominal fat deposits in obese individuals can limit visibility and mobility during laparoscopic dissection [11]. A prior history of acute cholecystitis was another clinically significant factor that correlated with operative difficulty, likely due to adhesions, distorted anatomy, and inflammatory changes that make Calot's triangle dissection more hazardous.

Additionally, the presence of a palpable gallbladder on clinical examination indicated chronic inflammation or gallbladder distension and was associated with more difficult operative fields [12].

Radiologically, gallbladder wall thickness greater than 3 mm was one of the most significant predictors of a difficult procedure. Wall thickening reflects chronic inflammation or ongoing acute cholecystitis, which can result in fibrotic and edematous tissues [13]. A contracted gallbladder was similarly predictive of difficulty, often seen in chronic calculous cholecystitis and suggesting dense adhesions and scarring. The presence of an impacted stone at the neck of the gallbladder or Hartmann's pouch complicates the exposure and dissection of Calot's triangle, increasing the risk of bile duct injury [14]. Another important finding was pericholecystic fluid on ultrasonography, which is indicative of active inflammation or microperforation, both of which contribute to altered anatomy and difficult dissection. Additionally, a dilated common bile duct (CBD >6 mm) was found to be associated with increased difficulty, potentially reflecting chronic stone passage, ongoing inflammation, or anatomical distortion [15,16].

These findings collectively suggest that a combination of easily assessable preoperative factors can serve as a predictive model for anticipating intraoperative challenges. Recognizing these predictors in the preoperative period can significantly help in surgical planning, including allocating sufficient time for the procedure, ensuring availability of senior surgical expertise, or even opting for early conversion to open surgery in cases where anatomy is not clearly defined. It also allows for better patient counseling regarding the risks involved, including potential complications or conversion to open cholecystectomy. Although this study is limited by its sample size and being conducted in a single institution, the observed associations offer valuable insights that can enhance surgical safety and outcomes. Future multicentric studies and the development of a standardized scoring system incorporating these variables could provide a more objective risk assessment tool for predicting difficult laparoscopic cholecystectomy.

Conclusion

Laparoscopic cholecystectomy is widely regarded as the gold standard for the surgical management of gallstone disease. However, intraoperative difficulties can significantly affect the safety, duration, and outcome of the procedure. This study highlights that a number of preoperative clinico-radiological factors—such as advanced age, male gender, high body mass index, previous episodes of cholecystitis, palpable gallbladder, gallbladder wall thickness >3 mm, contracted gallbladder, impacted stone at the neck, pericholecystic fluid, and dilated common bile duct—are significantly associated with increased intraoperative difficulty.

The recognition of these factors in the preoperative period can serve as a reliable guide for anticipating technical challenges during laparoscopic cholecystectomy. Early identification enables better preparation, informed surgical planning, adequate resource allocation, and appropriate patient counseling regarding possible complications and conversion to open surgery. This predictive insight not only improves operative safety but also helps in optimizing surgical outcomes. Further large-scale, multicenter studies are warranted to validate these findings and to possibly develop a comprehensive predictive scoring system that can be universally applied in clinical practice.

References

1. Wakabayashi G, Iwashita Y, Hibi T, Takada T, Strasberg SM, Asbun HJ, Endo I, Umezawa A, Asai K, Suzuki K, Mori Y, Okamoto K, Pitt HA, Han HS, Hwang TL, Yoon YS, Yoon DS, Choi IS, Huang WS, Giménez ME, Garden OJ, Gouma DJ, Belli G, Dervenis C, Jagannath P, Chan ACW, Lau WY, Liu KH, Su CH, Misawa T, Nakamura M, Horiguchi A, Tagaya N, Fujioka S, Higuchi R, Shikata S, Noguchi Y, Ukai T, Yokoe M, Cherqui D, Honda G, Sugioka A, de Santibañes E, Supe AN, Tokumura H, Kimura T, Yoshida M, Mayumi T, Kitano S, Inomata M, Hirata K, Sumiyama Y, Inui K, Yamamoto M. Tokyo Guidelines 2018: surgical management of acute cholecystitis: safe steps in laparoscopic cholecystectomy for acute cholecystitis (with videos). J Hepatobiliary Pancreat Sci. 2018 Jan;25(1):73-86. doi: 10.1002/jhbp.517. Epub 2018 Jan 10. PMID: 29095575.
2. Baral S, Chhetri RK, Thapa N. Utilization of an Intraoperative Grading Scale in Laparoscopic Cholecystectomy: A Nepalese Perspective. Gastroenterol Res Pract. 2020 Nov 24; 2020:8954572. doi: 10.1155/2020/8954572. PMID: 33299408; PMCID: PMC7710418.
3. Ali A, Saeed S, Khawaja R, Samnani SS, Farid FN. Difficulties in laparoscopic cholecystectomy: Conversion versus surgeon's failure. J Ayub Med Coll Abbottabad. 2016 Oct-Dec;28(4):669-671. PMID: 28586581.
4. Târcoveanu E, Vasilescu A, Lupaşcu C, Vlad N, Moraru M, Stanciu C, Bejan V, Bradea C. Laparoscopic Cholecystectomy in Cirrhotic Patients. Chirurgia (Bucur). 2020 Mar-Apr;115(2):213-219. doi: 10.21614/chirurgia.115.2.213. PMID: 32369725.
5. Dili A, Bertrand C. Laparoscopic ultrasonography as an alternative to intraoperative cholangiography during laparoscopic cholecystectomy. World J Gastroenterol. 2017 Aug 7;23(29):5438-5450. doi:

10.3748/wjg.v23.i29.5438. PMID: 28839445; PMCID: PMC5550794.
6. Nassar AHM, Hodson J, Ng HJ, Vohra RS, Katbeh T, Zino S, Griffiths EA; CholeS Study Group, West Midlands Research Collaborative. Predicting the difficult laparoscopic cholecystectomy: development and validation of a preoperative risk score using an objective operative difficulty grading system. Surg Endosc. 2020 Oct;34(10):4549-4561. doi: 10.1007/s00464-019-07244-5. Epub 2019 Nov 15. Erratum in: Surg Endosc. 2023 Mar;37(3):2415. doi: 10.1007/s00464-023-09888-w. PMID: 31732855.
7. AlKhlaiwy O, AlMuhsin AM, Zakarneh E, Taha MY. Laparoscopic cholecystectomy in situs inversus totalis: Case report with review of techniques. Int J Surg Case Rep. 2019; 59:208-212. doi: 10.1016/j.ijscr.2019.05.050. Epub 2019 May 31. PMID: 31181389; PMCID: PMC6556755.
8. Neogi P, Kumar P, Kumar S. Low-pressure Pneumoperitoneum in Laparoscopic Cholecystectomy: A Randomized Controlled Trial. Surg Laparosc Endosc Percutan Tech. 2020 Feb;30(1):30-34. doi: 10.1097/SLE.0000000000000719. PMID: 31425453.
9. Scott J, Singh A, Mayhew PD, Brad Case J, Runge JJ, Gatineau M, Kilkenny J. Perioperative Complications and Outcome of Laparoscopic Cholecystectomy in 20 Dogs. Vet Surg. 2016 Nov;45(S1):O49-O59. doi: 10.1111/vsu.12534. Epub 2016 Aug 9. PMID: 27503575.
10. Dokmak S, Amharar N, Aussilhou B, Cauchy F, Sauvanet A, Belghiti J, Soubrane O. Laparoscopic Repair of Post-cholecystectomy Bile Duct Injury: an Advance in Surgical Management. J Gastrointest Surg. 2017 Aug;21(8):1368-1372. doi: 10.1007/s11605-017-3400-7. Epub 2017 Mar 27. PMID: 28349333.
11. Giger U, Michel JM, Vonlanthen R, Becker K, Kocher T, Krähenbühl L. Laparoscopic cholecystectomy in acute cholecystitis: indication, technique, risk and outcome. Langenbecks Arch Surg. 2005 Sep;390(5):373-80. doi: 10.1007/s00423-004-0509-4. Epub 2004 Aug 14. PMID: 15316783.
12. Zeidan MM, Pandian TK, Ibrahim KA, Moir CR, Ishitani MB, Zarroug AE. Laparoscopic cholecystectomy in the pediatric population: a single-center experience. Surg Laparosc Endosc Percutan Tech. 2014 Jun;24(3):248-50. doi: 10.1097/SLE.0b013e3182a4c039. PMID: 24887542.
13. Stanisic V, Milicevic M, Kocev N, Stojanovic M, Vlaovic D, Babic I, Vucetic N. Prediction of difficulties in laparoscopic cholecystectomy on the base of routinely available parameters in a smaller regional hospital. Eur Rev Med Pharmacol Sci. 2014;18(8):1204-11. PMID: 24817296.
14. Cunningham AJ. Laparoscopic surgery--anesthetic implications. Surg Endosc. 1994 Nov;8(11):1272-84. doi: 10.1007/BF00188282. PMID: 7831596.
15. Omar MA, Redwan AA, Mahmoud AG. Single-incision versus 3-port laparoscopic cholecystectomy in symptomatic gallstones: A prospective randomized study. Surgery. 2017 Jul;162(1):96-103. doi: 10.1016/j.surg.2017.01.006. Epub 2017 Feb 28. PMID: 28256257.
16. Coelho JCU, Dalledone GO, Martins Filho EL, Ramos EJB, Roeder da Costa MA, de Loyola E Silva OOHM. Feasibility of Routine Ambulatory Laparoscopic Cholecystectomy in Brazil. JSLS. 2019 Apr-Jun;23(2):e2019.00016. doi: 10.4293/JSLS.2019.00016. PMID: 31097907; PMCID: PMC6502133.