

**Original Article**

## Pre-Operative Prediction of Difficult Laparoscopic Cholecystectomy by Clinical Assessment and Ultrasonographic Parameters

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**OPEN ACCESS****ABSTRACT****Corresponding Author:**

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Laparoscopic cholecystectomy (LC) is the gold standard for symptomatic cholelithiasis, offering advantages in recovery and postoperative outcomes. However, technical difficulty varies, especially in patients with specific clinical and ultrasonographic risk factors. To evaluate preoperative predictors of difficult LC using clinical and ultrasonographic parameters, facilitate risk stratification, and improve surgical safety and perioperative outcomes. This prospective cross-sectional study included 86 adult patients with clinically and ultrasonographically confirmed cholelithiasis scheduled for elective LC at Parul Sevashram Hospital, Vadodara. Detailed clinical histories, laboratory tests, and optimized preoperative assessment—including ultrasonography for gallbladder wall thickness, impacted stones, and pericholecystic fluid—were performed. Standard four-port LC was conducted; intraoperative findings and surgical difficulty were recorded and analyzed. The majority of participants were middle-aged females with a high prevalence of comorbidities and overweight BMI. Common risk factors included gallbladder wall thickening (38.4%), prior hospitalization for acute cholecystitis (37.2%), and impacted stones (32.6%). Difficult surgeries accounted for 60.5% of cases, with a mean operative duration of 77.4 minutes. Statistical analysis revealed that high-risk category, advanced age, previous cholecystitis, wall thickening, and impacted stones were significantly associated with increased intraoperative difficulty. Comprehensive preoperative clinical and ultrasonographic evaluation is instrumental in predicting difficult laparoscopic cholecystectomy. Identifying high-risk patients allows for improved surgical planning, resource allocation, and patient counseling, ultimately reducing perioperative complications and enhancing clinical outcomes.

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**Keywords:** Laparoscopic cholecystectomy, Cholelithiasis, Risk stratification, Clinical predictors, Ultrasonographic parameters, Surgical difficulty, Preoperative assessment, Gallbladder wall thickening, Impacted gallstone, Pericholecystic fluid.

**INTRODUCTION**

Laparoscopic cholecystectomy (LC) has emerged as the gold standard for treating symptomatic cholelithiasis and related gallbladder disorders, offering distinct advantages over open surgery such as reduced postoperative pain, shorter hospital stay, early return to normal activity, and superior cosmetic outcomes. (1,2) Cholelithiasis, one of the leading causes of gastrointestinal morbidity, affects about 4–6% of the Indian population, with higher prevalence among middle-aged women in northern regions. (3,4) Although LC is routinely performed, the procedure can be technically demanding in cases with severe inflammation, adhesions, or altered anatomy, resulting in complications or conversion to open cholecystectomy in 2–15% of cases. (5,6)

Predicting a difficult LC preoperatively is crucial for effective surgical planning, better resource utilization, and improved patient counseling. (7) Clinical factors such as advanced age, male gender, obesity, history of cholecystitis, prior upper abdominal surgery, and comorbidities like diabetes or chronic obstructive pulmonary disease increase operative complexity. (8,9) Ultrasonographic parameters including thickened gallbladder wall, contracted gallbladder, pericholecystic fluid, impacted stones, and dilated common bile duct also correlate with surgical difficulty. (10,11) This study aims to evaluate clinical and ultrasonographic predictors of difficult LC to facilitate risk stratification, enhance operative safety, and improve perioperative outcomes.

## OBJECTIVE

To enhance the safety of the procedure by identifying potential preoperative risk factors, thereby aiding in better surgical planning, minimizing intraoperative complications, and reducing postoperative morbidity for patients.

## METHODOLOGY

The study was conducted in the Department of General Surgery, Parul Sevashram Hospital, Parul Institute of Medical Sciences & Research (PIMSR), Vadodara, Gujarat, after obtaining approval from the Parul University Institutional Ethics Committee for Human Research (PUIECHR).

### Inclusion Criteria

- Patients aged above 18 years.
- Clinically and ultrasonographically diagnosed cases of cholelithiasis.
- Patients planned for elective laparoscopic cholecystectomy.

### Preoperative Optimization

- Detailed clinical history and physical examination.
- Routine investigations including complete hemogram, liver function tests, and PT/INR.
- Ultrasonography abdomen and pelvis to assess gallbladder wall thickness, stones, and pericholecystic fluid.
- Chest X-ray (PA view) and ECG for anesthetic fitness.
- Optimization of comorbidities such as diabetes mellitus, hypertension, or COPD before surgery.
- Informed written consent obtained after explaining the procedure, risks, and possible conversion to open surgery.

### Surgical Technique

- Standard four-port antegrade laparoscopic cholecystectomy performed under general anesthesia.
- Ports placed as follows: one umbilical (camera), one epigastric (dissection), and two in the right upper quadrant (working ports).
- Dissection of Calot's triangle to identify and clip the cystic duct and artery.
- Gallbladder separated from the liver bed using monopolar cautery.
- Specimen retrieved via the umbilical port with a retrieval bag.
- Conversion to open cholecystectomy done in case of dense adhesions, excessive bleeding, or unclear anatomy.

## RESULT

**Table 1: Demographic and Clinical Characteristics**

Parameter	Category	Frequency (n=86)	Percentage (%)
Age	31–50 years	36	41.9
	51–70 years	32	37.2
Gender	Female	45	52.3
	Male	41	47.7
Occupation	Housewife	35	40.7
	Employed/Job	17	19.8
	Farmer	12	14.0
Comorbidities	Present	30	34.9
	Absent	56	65.1
BMI Group	Normal	48	55.8
	Overweight	38	44.2

This table captures demographic profiles including age, gender, underlying comorbidities, and major occupation groups of the study participants. Most patients were middle-aged, with a slight female majority and a high proportion of housewives. Over a third had medical comorbidities, and nearly half were overweight.

**Table 2: Key Preoperative and Clinical Findings**

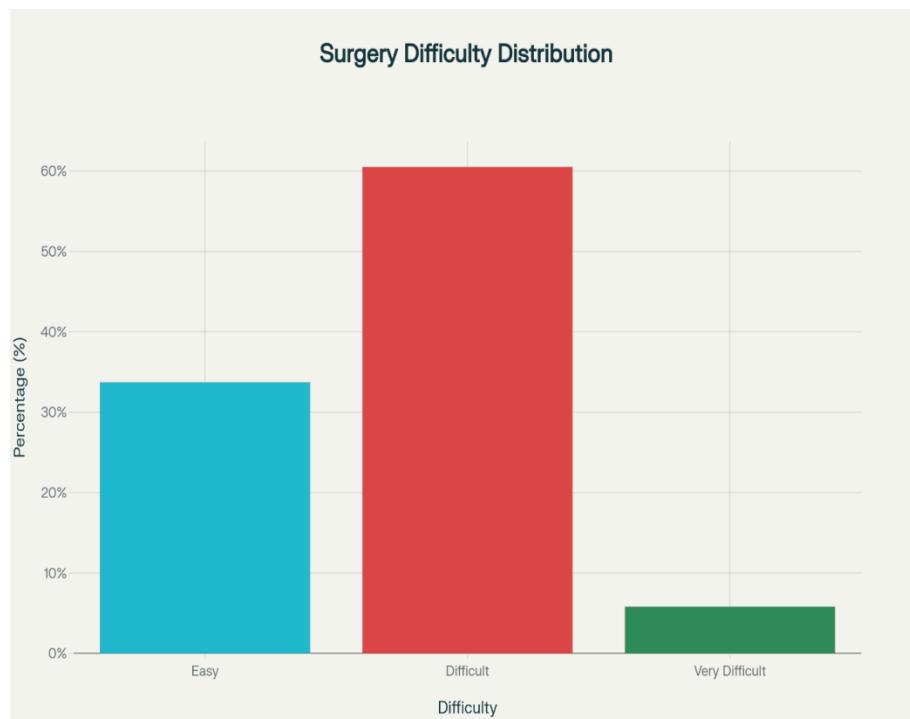
Parameter	Present	Percentage (%)	Absent	Percentage (%)
Gallbladder wall thickening	33	38.4	53	61.6
Pericholecystic collection	10	11.6	76	88.4
Impacted gallstone	28	32.6	58	67.4
Palpable gallbladder	28	32.6	58	67.4
Acute cholecystitis history	32	37.2	54	62.8

This table summarizes the distribution of key imaging and clinical risk factors in patients before surgery. Wall thickening, impacted stones, and prior hospitalizations for acute cholecystitis were common findings linked to intraoperative challenges.

**Table 3: Intraoperative Assessment and Surgical Difficulty**

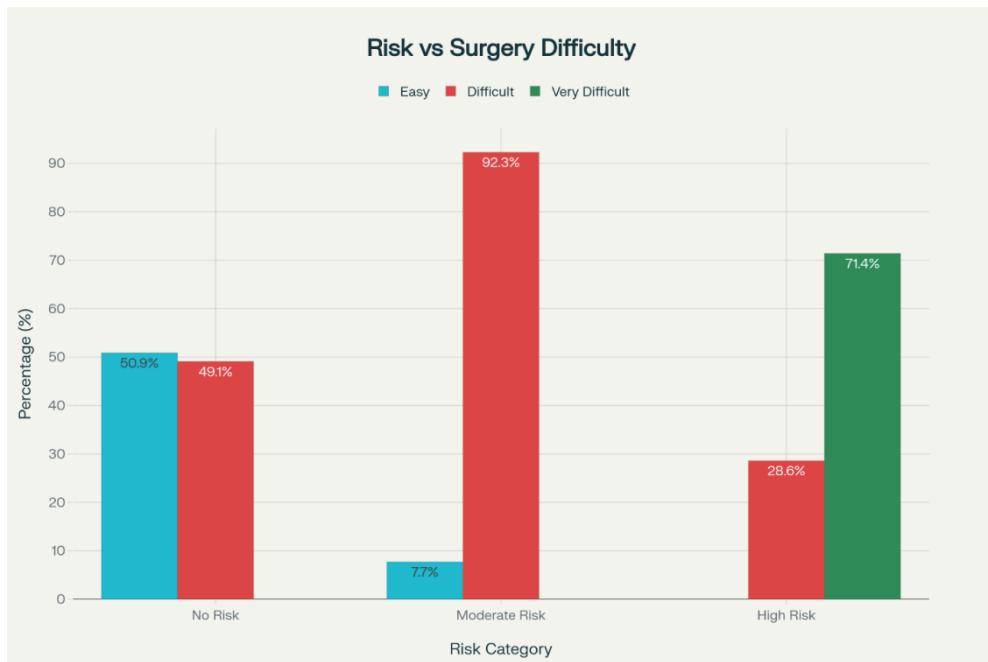
Parameter	Category	Frequency	Percentage (%)
Duration of surgery	<60 minutes	29	33.7
	60–120 minutes	52	60.5
	>120 minutes	5	5.8
Surgical Difficulty	Easy	29	33.7
	Difficult	52	60.5
	Very Difficult	5	5.8

This table presents perioperative performance metrics, highlighting that the majority of surgeries were categorized as 'difficult' and spanned 60–120 minutes in duration.



**Chart 1: Distribution of Surgery Difficulty Levels**  
Distribution of Surgery Difficulty Levels among Study Participants

This column chart displays the proportion of easy, difficult, and very difficult laparoscopic cholecystectomies, emphasizing that the 'difficult' category formed the largest share.



**Chart 2: Association Between Risk Category and Surgical Difficulty Levels**  
Association Between Risk Category and Surgical Difficulty Levels

This chart visualizes the strong correlation between preoperative risk categories and surgery difficulty level, with high-risk patients much more likely to experience very difficult procedures.

## DISCUSSION

This prospective cross-sectional study analyzed 86 patients undergoing laparoscopic cholecystectomy for cholelithiasis, presenting key epidemiological, clinical, and operative trends consistent with national and international literature. The mean age of the cohort was  $48.8 \pm 15.16$  years, with the majority (79.1%) falling between 31 and 70 years—a distribution closely matched by findings from Patel AM (2022) (12) and Parihar VK (2023), (13) who also reported a high prevalence in middle-aged adults, underscoring the disease's frequency in this demographic.

### Distribution of Surgery Difficulty Levels among Study Participants

Gender-wise, a slight female predominance (52.3%) was noted, which aligns with reports by Bansal A et al. (2014) (14) and MedResearch (2019) (15) that consistently document higher rates of cholelithiasis among women, possibly due to hormonal or metabolic factors. The female-to-male ratio in this study (1:0.91) is comparable to ratios observed in previous studies, confirming persistent gender trends.

### Association Between Risk Category and Surgical Difficulty Levels

Comorbidity profiles revealed that a significant portion (34.9%) of patients had associated conditions, such as diabetes or hypertension. This is in line with reports by Memon J et al. (2021) (16)—who found similar rates of comorbid diabetes/hypertension—and Baddam A et al. (2023), (17) who demonstrated an even higher overall comorbidity burden in their sample. The presence of comorbidities can complicate perioperative management, emphasizing the need for thorough pre-surgical optimization.

Body mass index (BMI) assessment revealed no underweight or obese patients, with 55.8% having normal BMI and 44.2% classified as overweight. This supports the findings of Malik et al. (2020) (18), Bansal et al., and Sumit et al. (2024) (19), all of whom reported higher-than-average BMI categories among cholelithiasis patients. Elevated BMI may increase the risk for gallstone formation and influence surgical complexity.

Preoperative clinical and ultrasound findings were commonly positive for risk markers: thickened gallbladder wall (38.4%, higher than Chakraborty C (2024) (20) and Panneer Selvam P (2024)) (21), impacted stones (32.6%), and prior history of hospitalization for acute cholecystitis (37.2%). Comparative studies report similar but slightly lower rates for these findings, confirming their utility as predictors for intraoperative difficulty.

Operative duration most frequently ranged from 60–120 minutes (60.5% of cases), with a mean of  $77.4 \pm 22.7$  minutes—comparable to studies by Chandra Nath H (2021) (22) and Parmar AK (2012) (23), which note a similar spread of operative times in comparable settings. Longer operative time often reflected increased difficulty or perioperative complications.

Risk stratification using combined clinical and ultrasonographic parameters proved highly predictive of operative challenge: patients in the high-risk group experienced 'very difficult' surgeries in 71.4% of cases, with statistical significance ( $p < 0.001$ ). These results reinforce the value of preoperative scoring systems proposed by Khetan AK (2017) (24) and Trehan et al. (2023) (25), both of whom validated the correlation between risk scores and surgical outcomes. Our findings further established that advanced age, prior cholecystitis hospitalization, gallbladder wall thickening, and impacted stones—when present—significantly increased difficulty level and operative risk ( $p < 0.001$ ). Overall, the study confirms established risk associations and highlights the importance of comprehensive preoperative evaluation in predicting intraoperative difficulty during laparoscopic cholecystectomy, facilitating better operative planning and improving patient outcomes.

## CONCLUSION

In this study, the majority of patients undergoing laparoscopic cholecystectomy were middle-aged females, with significant clinical and ultrasonographic risk factors such as gallbladder wall thickening, history of acute cholecystitis, and impacted stones frequently present. Most procedures were classified as difficult, and statistical analysis demonstrated that high preoperative risk scores, advanced age, history of hospitalization for acute cholecystitis, thickened gallbladder wall, and impacted stones were significantly associated with increased intraoperative difficulty. These findings highlight the value of thorough preoperative assessment in identifying patients at higher risk for complex surgery, enabling better operative planning and potentially reducing perioperative morbidity.

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