

## Original Research Article

# ASSESSING PREDICTORS FOR COMPLEX LAPAROSCOPIC CHOLECYSTECTOMY: A LOOK AT PRE- AND INTRAOPERATIVE FACTORS - A RETROSPECTIVE ANALYSIS

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Received : 16/12/2023  
Received in revised form : 01/03/2024  
Accepted : 16/03/2024

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DOI: 10.5530/ijmedph.2024.1.101

Source of Support: Nil,  
Conflict of Interest: None declared

**Int J Med Pub Health**  
2024; 14 (1); 549-553

**ABSTRACT**

**Background:** Across the globe, laparoscopic cholecystectomy (LC) procedures are performed extensively. Despite their relatively low occurrence rate, a substantial number of patients encounter significant challenges, prompting experts to label it as a "rare but common" problem. This study sought to evaluate different operative factors predicting the difficulty of laparoscopic cholecystectomy.

**Materials and Methods:** This retrospective study examined a cohort of 100 patients diagnosed with cholelithiasis, as confirmed by abdominal ultrasonography (USG) records from the hospital database. Surgical procedures were retrospectively categorised into three groups based on postoperative assessments: easy, difficult, and very difficult, considering factors such as procedural duration, bile/stone spillage, duct injury, and conversion to open cholecystectomy. Upon admission, all patients underwent preoperative risk factor evaluations, and intraoperative findings were documented in their records. Data collected were analysed using SPSS-22 software, with statistical analysis conducted using the Chi-square test.

**Results:** The findings of this study indicate that several factors contribute significantly to the complexity of laparoscopic cholecystectomy procedures. These factors include obesity, comorbid diseases such as Type II diabetes mellitus, prior episodes of acute cholecystitis or pancreatitis, delayed surgery beyond 72 hours following onset of symptoms, increased gallbladder wall thickness, presence of multiple stones, and calculi larger than 1 cm in size. These variables were observed to correlate with an increased likelihood of encountering difficult or very difficult surgical procedures, as documented in the patients' hospital records from admission to discharge. Additionally, the study noted that conversion to open cholecystectomy was necessary in 15% of the cases.

**Conclusion:** Integration of these variables necessitates a thorough assessment and development of a standardised scoring system to predict the likelihood of encountering a challenging laparoscopic cholecystectomy. By accurately predicting the probability of a difficult procedure, surgeons can proactively prepare for potential risk factors and intraoperative complications. Furthermore, such predictive tools can aid in forecasting the likelihood of requiring conversion to an open cholecystectomy, enabling surgeons to make more informed decisions and optimise patient outcomes.

**Keywords:** Cholelithiasis, laparoscopic cholecystectomy, cholecystitis, pain abdomen, difficult cholecystectomy, obesity.

## INTRODUCTION

Laparoscopic cholecystectomy (LC) is widely considered a safe and effective procedure for gallbladder removal. However, challenges during surgery can lead to complications, prolonged operative times, and extended hospital stays. Recognizing and managing these challenges before and during surgery is essential for improving patient outcomes and surgical efficiency.<sup>[1]</sup>

Although LC is generally successful, certain factors such as anatomical variations, pneumoperitoneum creation, peritoneal cavity access, adhesion release, and gallbladder extraction can complicate the procedure, making it more challenging and time-consuming.<sup>[2]</sup> Despite these complexities, LC remains the preferred treatment for most gallbladder disorders due to its numerous benefits, including shorter hospital stays, reduced postoperative pain, improved cosmetic results, and faster recovery.<sup>[3,4]</sup>

Predicting a "difficult laparoscopic cholecystectomy" preoperatively can help mitigate complications, enhance patient safety, facilitate appropriate preoperative planning and counselling, guide the choice between open and laparoscopic surgery, and reduce conversion rates to open procedures. Therefore, this study aims to identify various parameters predictive of difficult laparoscopic cholecystectomy, allowing for early intervention and prevention of complications.<sup>[5]</sup>

Our retrospective study focuses on pre- and intraoperative predictors associated with challenging laparoscopic cholecystectomy cases. By analysing patient demographics, preoperative imaging findings, and intraoperative variables, we aim to gain a comprehensive understanding of the factors contributing to procedure complexity. This understanding can inform the development of predictive models, decision support tools, and tailored strategies to improve patient care, minimise surgical complications, and optimise overall surgical outcomes.

In summary, our study contributes to ongoing efforts to refine surgical techniques and enhance patient management in the field of laparoscopic cholecystectomy, ultimately striving for better patient outcomes and improved surgical practice.

## MATERIAL AND METHODS

This retrospective study examined 100 patients diagnosed with cholelithiasis, confirmed via abdominal ultrasonography (USG) from hospital records. Preoperative prediction of intraoperative difficulty was based on age, obesity, comorbidities, interval of operation from the onset of symptoms, previous history of cholecystitis and USG findings. Surgical procedures were categorised postoperatively as easy, difficult, or very difficult based on factors such as operative time, bile/stone spillage, duct injury, and conversion to open cholecystectomy.

Informed consent was obtained from all patients whose records were retrieved.

Patients with acute or chronic calculous cholecystitis, gallbladder polyps, and symptomatic cholelithiasis, regardless of age or sex, were included. Exclusions comprised patients with associated CBD calculi, gallbladder perforations, acalculous cholecystitis, preoperatively diagnosed Mirizzi Syndrome, suspected or proven gallbladder malignancy, deranged liver function tests, features of obstructive jaundice, and those unfit for general anaesthesia.

The methodology involved obtaining detailed clinical histories, including demographic data (age, sex, obesity), previous acute attacks, fever, and comorbid diseases (hypertension, cardiovascular diseases). Diagnosis confirmation utilised abdominal USG, and patients consenting to participate were randomly selected. Laboratory evaluations included leukocyte count and preoperative liver function tests. Cholecystectomies were performed using the standard four-port technique by experienced surgeons. Intravenous antibiotics were administered upon admission and continued postoperatively. Intraoperative events were recorded, with timing noted from the first port incision until the last port closure. Surgical procedures were categorised based on predetermined criteria:

1. **Easy:** Time taken for surgery <60 min, no bile spillage, no injury to duct, artery
2. **Difficult:** Time taken for surgery 60–120 min, bile or stone spillage, injury to duct, no conversion to open cholecystectomy.
3. **Very Difficult:** Time taken >120 min, conversion to open cholecystectomy

The first port (10-mm cannula) was inserted supra-umbilically, followed by three 5–10 mm ports along the subcostal margin under direct vision at midline, midclavicular, and anterior axillary line.

### Statistical Analysis

The clinical and demographic characteristics of the study population were summarised using descriptive statistics. To explore associations between variables, the chi-square test and other appropriate statistical tests were employed. Statistical analyses were conducted using SPSS for Windows version 22.0 software. A critical p-value of less than 0.05 was considered indicative of a significant difference for comparisons.

## RESULTS

As per table 1 LC was performed in 100 patients at our hospital out of which 45 were males and 55 were females which suggest the study was female preponderance. Patients were divided into three groups of surgeries i.e. easy, difficult and very difficult surgery groups according to criteria for laparoscopic cholecystectomy. The mean age of patients was 46±1.1 years in case of surgeries completed in a time period <60 min (easy cases),

51±2.1 in case of difficult surgeries (Time taken for surgery 60–120 min) and 52±087 years in case of very difficult surgeries. Data regarding various assessed factors. 30 cases (25%) categorised into difficult surgery were converted to open cholecystectomy. [Table 1]

Table 2 highlights several contributing factors to the need for open cholecystectomy, including challenges in accurately identifying anatomy, biliary tract damage, multiple stone spillage, increased gallbladder thickness, and liver parenchyma fibrosis.

This study investigated various operative predictors for laparoscopic cholecystectomy and identified several significant factors associated with difficult and extremely difficult surgical procedures. These factors include obesity, comorbid diseases, a history of acute cholecystitis or pancreatitis, delayed surgery following a 72-hour period of onset of symptoms, increased gallbladder wall thickness, liver parenchymal fibrosis, presence of multiple stones, and calculi larger than 1 cm in size. [Table 2]

**Table 1: Comparing the patient's results with the easy, difficult, and very difficult laproscopic cholecystectomy criteria**

Patient Findings n=100				Easy (n=55)	Difficult (n=30)	Very (n=15)	Difficult
Sex	Male (n=45)			16	17	12	
	Female (n=55)			39	13	3	
Mean Age				46±1.1	51±2.1	52±0.8	
Obesity status	BMI (Non- obese) n=57			41	12	4	
	BMI >30Kg/m <sup>2</sup> (Obese) n=43			23	10	10	
Co morbid disease (n=51)				17	20	14	
Ultrasound findings	Increased gallbladder thickness of	Fibrosis of	liver	3	18	13	
			parenchyma	1	10	8	
Previous history of acute cholecystitis or pancreatitis				9	16	12	
Surgery after 72 hour of onset of symptoms				11	19	14	
Size of calculi more than 1 cm (n=40)				15	15	10	
Multiple stones (n=70)				35	20	15	
Conversion to open surgery				-	-	15	

**Table 2: Comparison of Predictable factors for difficult and very difficult cases**

Predictable Factors	Patients categorized into difficult and very difficult cases	Patients categorized into easy cases	p-value
Gender	Male=29 Female=16	Male= 16 Female=39	0.21
Age	52.4 years	48 years	0.01*
Non-obese	16	41	0.01*
Obese (BMI>30 kg/m <sup>2</sup> )	20	23	
Co-morbid diseases	34	17	0.01*
Previous history of acute cholecystitis or pancreatitis	28	9	0.01*
Surgery after 72 hour of onset of symptoms	33	11	0.01*
Increased thickness of gallbladder	31	3	0.01*
Fibrosis of liver parenchyma	18	1	0.01*
Size of calculi more than 1 cm	25	15	0.01*
Multiple stones	35	35	0.11
Conversion to open cholecystectomy	15	0	0.01*

## DISCUSSION

Laparoscopic cholecystectomy (LC) stands as a commonly performed surgical procedure in general surgical centres and remains the preferred treatment for gallbladder-related conditions<sup>6</sup>. Typically, LC poses increased challenges as individuals surpass the age of 50, primarily due to recurring cholecystitis episodes and heightened risks associated with previous surgical experiences. Interestingly, our study found age over 50 to be insignificant as a predictor of difficult LC, which aligns with prior research. However, it's worth noting that our study group's age criteria (34 to 65 years old) differed from previous studies.<sup>[7]</sup>

The primary objective of our study is to identify variables indicative of potential complications during laparoscopic cholecystectomy, thereby enabling early preventive measures. We evaluated various operative predictors and identified several significant factors associated with difficult and extremely difficult procedures, including obesity, comorbid diseases including Type II diabetes mellitus, prior acute cholecystitis or pancreatitis, delayed surgery beyond 72 hours of onset of symptoms, increased gallbladder wall thickness, liver parenchyma fibrosis, presence of multiple stones, and calculi larger than 1 cm in size. These predictive factors align with the findings of other researchers.<sup>[9]</sup>

Dhanke PS et al. also identified pericholecystic collection, palpable gallbladder, impacted stone, and high body mass index as important predictors of difficult laparoscopic cholecystectomy [1,8]. Additionally, a study utilising clinical and ultrasonographic parameters found male gender, body mass index >30 kg/m<sup>2</sup>, history of acute pancreatitis or cholecystitis, prior upper abdominal surgery, and gallbladder wall thickness >3 mm to be significant predictors of difficult cases.<sup>[10,11]</sup> Randhawa JS et al. developed a scoring system to anticipate the level of difficulty of LC preoperatively, based on history, clinical, and sonological results.<sup>[7]</sup>

It's essential to note that the rate of conversion from laparoscopic to open cholecystectomy varies widely according to the literature.<sup>[11,12]</sup> Our study has a few limitations, including its retrospective nature, which may limit generalizability, and the relatively small sample size.

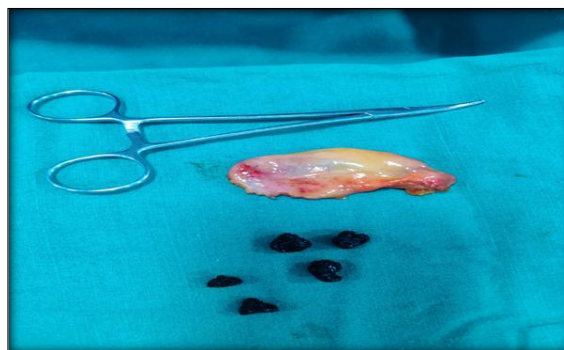
## CONCLUSION

Symptomatic gallstone disease poses a significant healthcare burden, and laparoscopic cholecystectomy has emerged as the preferred treatment modality due to its minimally invasive nature and generally favourable outcomes. However, the complexity of laparoscopic cholecystectomy can vary widely among patients, ranging from quick and straightforward procedures to more intricate and time-consuming ones.

Understanding the multitude of factors that contribute to the difficulty of laparoscopic cholecystectomy requires a comprehensive approach. These factors may include patient-related variables such as obesity, comorbidities, previous history of acute cholecystitis or pancreatitis, as well as intraoperative factors like anatomical variations, bile duct injury, and difficulty in identifying critical structures.

To effectively navigate the nuances of challenging laparoscopic cholecystectomy cases, it becomes imperative to develop a uniform scoring system that can integrate and weigh these variables appropriately. Such a scoring system would enable surgeons to preoperatively assess the likelihood of encountering difficulties and tailor their approach accordingly. By accurately predicting the complexity of the procedure, surgeons can better prepare for potential intraoperative challenges, allocate resources effectively, and optimise patient outcomes. While existing research provides valuable insights into the factors influencing the difficulty of laparoscopic cholecystectomy, further prospective studies are needed to validate and refine predictive models. These studies would not only enhance our understanding of the intricate interplay between various variables but also pave the way for the development of more precise and reliable scoring systems. Ultimately, advancing our knowledge in

this area will contribute to improved patient care and surgical outcomes in the management of symptomatic gallstone disease.



**Figure 1: Cholecystectomy specimen with black pigment stones**



**Figure 2: Cholecystectomy specimen with large luminal stone**

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