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Original Research Article

Retrospective Evaluation of Predictive Risk Factors for Difficult Laparoscopic Cholecystectomy

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Abstract:

Background: Laparoscopic cholecystectomy (LC) is the gold standard treatment of symptomatic gallstone disease. LC is considered minimally invasive surgery and with some challenging cases, this may require conversion to open surgery. Correct surgical programming prior to surgery is key in ensuring complete patient care and preparedness for surgical intervention.

Aim: To evaluate pre-operative risk factors that can predict difficult laparoscopic cholecystectomy in difficult cases focusing on the rate of conversion to open.

Method: A retrospective observational study of patients who underwent elective LC was conducted at Department of General Surgery, AIIMS, Patna. 94 patients were identified in this study. Demographic, clinical, biochemical, and radiological variables were extracted from hospital records. Patients were divided into two groups: the group in which conversion to open cholecystectomy was required and the group which remained as LC. Statistical analysis of the data was conducted using SPSS (version 25) and a p-value of <0.05 was regarded as significant.

Results: Of 94 patients, 7 (7.4%) required conversion to open surgery. Age greater than 50 (conversion rate: 18.75% p=0.015) and female gender (conversion rate: 9.6%, p=0.02) were both significantly predictive of difficult laparoscopic cholecystectomy. In terms of clinical symptoms, dyspepsia (p=0.04) was the only symptom that statistically correlated with the need for conversion in laparoscopic cholecystectomy. The remaining symptoms (i.e. pain, vomiting, jaundice, and fever) did not have a statistically significant p value.

Conclusion: Older age, female gender, and the presence of dyspeptic symptoms all appear to be significantly predictive factors of difficult laparoscopic cholecystectomy. Including these factors in pre-operative assessments may provide a better framework for surgical planning, complications, and ultimately outcomes.

Keywords: Conversion To Open Surgery, Dyspepsia, Gallstones, Gender, Laparoscopic Cholecystectomy, Predictive Risk Factors, Surgical Difficulty.

Introduction

Gallstone disease or cholelithiasis is a prevalent condition in approximately 10 to 15% of the general population globally [1]. Cholecystectomy significantly to gastrointestinal surgery, and cholecystectomy is the gold standard for treatment of symptomatic gallstones. The origin of the procedure extends back to 1882 when the first open cholecystectomy was performed by Carl Langebuch of Germany. One and a half centuries later in 1985, Dr. Erich Mühe of Germany developed laparoscopic cholecystectomy (LC), a groundbreaking innovation in the surgical management of gallbladder disease [2]. LC ever since has emerged as the gold standard treatment of most gallbladder pathologies since it is less invasive, causes less postoperative pain, recovers quicker, and has shorter hospitalization.

Although it is a very common and utilized procedure, laparoscopic cholecystectomy is not without complication. Athough it is safe and effective in the majority of cases, some percentage of patients have intraoperative complexities that result in longer surgery time, cause complications, and risk conversion to open cholecystectomy. Complications that may be faced during LC include anatomical variation, adhesions, fibrosis, gallbladder wall thickening, and difficulty in achieving pneumoperitoneum or in gallbladder extraction itself [3]. These types of complexities have a tremendous impact on surgical outcomes and patient safety, and it is for these reasons that anticipating potential complications before the procedure is of such great importance.

Preoperative prediction of LC difficulty level is advantageous in a number of ways. First, it allows more accurate informed consent and psychosocial preparation of the patient. Second, it allows for more effective planning of the operative schedule by surgical teams, e.g., deployment of skilled staff and operating time. Third, identification of high-risk patients can initiate increased postoperative monitoring and extended in-hospital stay, thus potentially improving overall patient outcome and resource management [4]. From a wider healthcare perspective, accurate prediction of risk enables optimization of hospital utilization of resources, i.e., operating room scheduling, ICU bed planning, and recovery ward availability.

Over the years, various clinical, radiological, and biochemical parameters have been suggested and investigated to predict the probable complexity of LC. These parameters include age, gender, body mass index (BMI), history of previous abdominal surgery, and certain ultrasonographic features like gallbladder wall thickening, pericholecystic fluid, and small gallbladder [5]. In addition, hematological factors like increased white blood cell count, increased alkaline phosphatase, and deranged liver function tests have also been investigated for their predictive role. The combined evaluation of these factors is aimed at giving a useful preoperative model to risk-stratify patients according to the predicted complexity of the surgery [6].

Epidemiologically, cholelithiasis is rare in the first two decades of life, with an increasingly developing incidence after age 21 and peaking in the fifth and sixth decades. Females are disproportionately represented and have a roughly 4:1 female-to-male ratio. With its high frequency and the frequency with which cholecystectomy is performed—especially in symptomatic patients, optimizing the surgical decision-making process is preferable. Interestingly, roughly 1–2% of asymptomatic gallstone patients will develop symptoms each year, again highlighting the workload that this condition imposes on surgical services [7].

Laparoscopic cholecystectomy has become the procedure of choice and has several patient-oriented advantages over open cholecystectomy. LC is not, however, complication-free. In certain clinical environments, laparoscopic surgery is more dangerous than open surgery, especially when intraoperative anatomy is difficult to define or in complications arising from intraoperative scarring or inflammation [8]. The identification and evaluation of credible predictive markers of complicated LC have thus taken central roles in present surgical practice.

Challenging LC is generally defined by longer operating time, increased blood loss, higher risk of open procedure conversion, and higher incidence of complications like bile duct injury or postoperative infection [9]. In this scenario, creating an evidence-based model for predicting surgical difficulty would not only improve patient care but also decrease total surgical morbidity. Surgeons with predictive data are able to take a more conservative and tailored approach, possibly choosing early conversion in extremely challenging cases to avoid disastrous complications.

With the identification of these clinical needs, the present retrospective study was designed to evaluate the numerous preoperative risk factors that could foretell challenging laparoscopic cholecystectomy. By examining parameters such as age, gender, BMI, history of previous surgery, ultrasound findings, and laboratory findings, the study aims to contribute evidence to the literature on preoperative risk stratification. The ultimate long-term goal is to improve intraoperative preparedness, minimize operative complications, lower the rate of unplanned conversions, and improve the overall surgical outcome.

The aim of this research is to determine reproducible and reliable predictors of difficulty in laparoscopic cholecystectomy. Once the predictive factors are incorporated into practice, we can move evidence-based decision-making forward, improve the quality of patient care, and maximize surgical workflow and hospital management. This research has the potential to lay the groundwork for follow-up studies that could lead to the creation of validated scoring systems or predictive algorithms, thus moving the frontier of patient-specific surgical planning in the field of minimally invasive surgery.

Methodology

Study Design: This was a retrospective observational study conducted to evaluate the predictive risk factors associated with difficult laparoscopic cholecystectomy, specifically cases requiring conversion to open surgery.

Study Area: The study was conducted in a department of general surgery, AIIMS, Patna, Bihar, India.

Study Duration: The data was collected retrospectively over a period of one year hospital records of patients who underwent laparoscopic cholecystectomy.

Sample Size: A total of 94 patients who underwent laparoscopic cholecystectomy for symptomatic gallstone disease were included in the study.

Sample Population: The sample included adult patients of both genders diagnosed with symptomatic gallstone disease who were scheduled for elective laparoscopic cholecystectomy.

Inclusion Criteria

- Patients aged 18 years and above.

- Patients are diagnosed with symptomatic gallstone disease.
- Patients who underwent elective laparoscopic cholecystectomy.
- Complete preoperative, intraoperative, and postoperative records available.

Exclusion Criteria

- Emergency laparoscopic cholecystectomy (e.g., for perforated gallbladder).
- Patients with incomplete medical records or missing key clinical/laboratory data.
- Patients with previously known malignancy or undergoing concurrent abdominal procedures.
- Patients who underwent primary open cholecystectomy.

Data Collection: The data for the research were collected retrospectively from hospital records. Demographic details of each patient were obtained, including name, age, and sex. Clinical details of each patient were reviewed, including presenting symptoms and physical examination findings. The laboratory investigations that were reviewed included the total leukocyte count (TLC), alkaline phosphatase (ALP), serum bilirubin, and liver enzyme levels. Radiological findings from pre-operative abdominal ultrasound also included gallbladder wall thickness, presence of pericholecystic fluid and impacted gallstones. The intra operative data collected were presence of dense adhesions, bleeding, intra operative common bile duct injury and intent to convert the laparoscopic procedure to an open cholecystectomy. Patients were divided into two groups based on the outcome of surgery; interval laparoscopic cholecystectomy where the laparoscopic approach was successful and emergency laparoscopic cholecystectomy where the laparoscopic approach was converted to an open surgical procedure.

Procedure: Every patient had elective laparoscopic cholecystectomy performed by surgeons experienced in laparoscopic cholecystectomy. The intraoperative indications for conversion to open cholecystectomy were the presence of adhesions, uncontrolled bleeding, uncertain anatomy, and suspicion of bile duct injury. Surgical difficulty and conversion data were recorded at the conclusion of each case.

Statistical Analysis: "All data was compiled and entered into Excel then analyzed with SPSS version 25. Baseline characteristics were summarized with descriptive statistics. Categorical variables were analyzed with the Chi-square test, or Fisher's exact test, and continuous variables were analyzed with the t-test or Mann-Whitney U test, as appropriate. A p-value of less than 0.05 was considered statistically significant."

Result

"Table 1 shows the age-wise distribution of 94 patients who underwent laparoscopic cholecystectomy. The majority of patients were in the 40–50 age group (44 patients), followed by 34 patients in the 20–40 age group, and 16 patients were above 50 years of age. The P value of 0.027 indicates a statistically significant association between age and the distribution of patients, suggesting that age may be a relevant factor in evaluating the likelihood of a difficult laparoscopic cholecystectomy.

Table 1: Age-wise distribution of patients (N = 94)

Age group (Years)	Number	P value
>50	16	**0.027**
40–50	44	
20–40	34	
Total	**94**	

Table 2 presents the age-wise distribution of cases that required conversion from laparoscopic to open cholecystectomy among 94 patients. Out of 78 patients aged ≤50 years, 74 successfully underwent laparoscopic surgery, while 4 required conversion. In contrast, among 16 patients aged >50 years, 13 had successful laparoscopic procedures and 3 required conversion. The conversion rate is notably higher in the >50 age group (18.75%) compared to the ≤50 age group (5.1%). The P value of 0.015 indicates a statistically significant association between increasing age and the likelihood of conversion, suggesting that older patients are at higher risk for difficult laparoscopic cholecystectomy.

Table 2: Age-wise cases underwent conversion (N = 94)

Age (Years)	Laparoscopic	Conversion	Total	P value
≤50	74	4	78	**0.015**
>50	13	3	16	
Total	**87**	**7**	**94**	

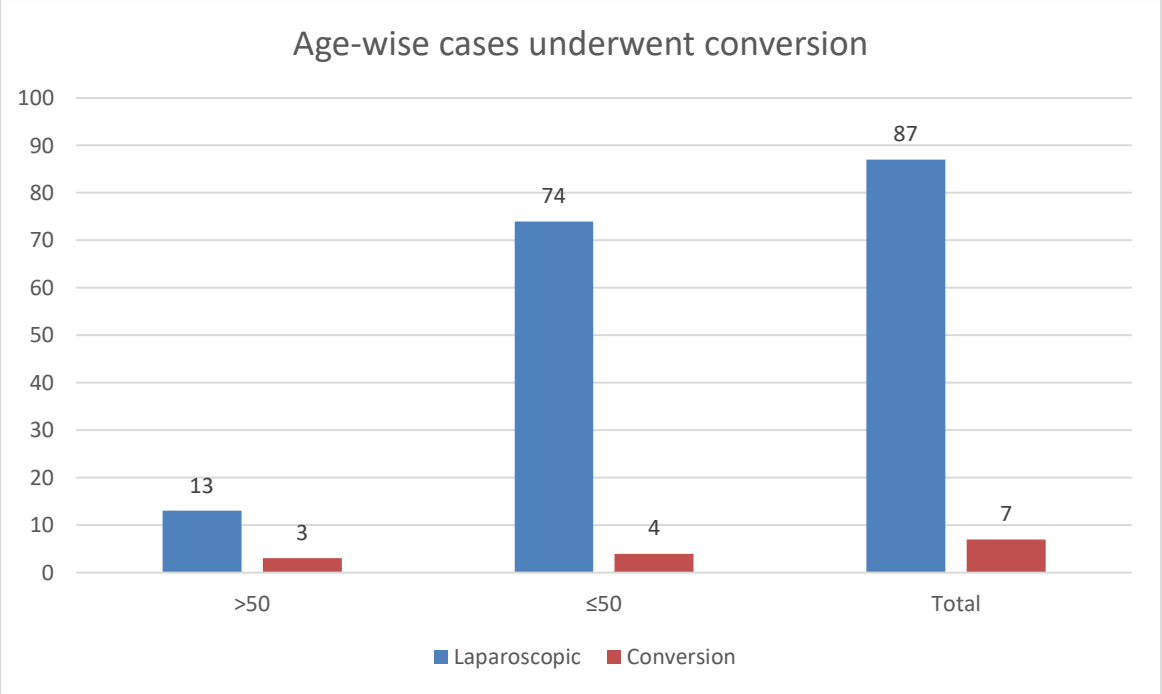


Table 3 illustrates the gender-wise distribution of cases that underwent conversion during laparoscopic cholecystectomy among 94 patients. Of the 42 male patients, 40 underwent successful laparoscopic surgery while 2 required conversion. Among the 52 female patients, 47 had successful laparoscopic procedures and 5 required conversions. The conversion rate was slightly higher in females (9.6%) compared to males (4.8%). The P value of 0.02 indicates a statistically significant association between gender and conversion rate, suggesting that female patients may have a higher risk of requiring conversion to open surgery during laparoscopic cholecystectomy.

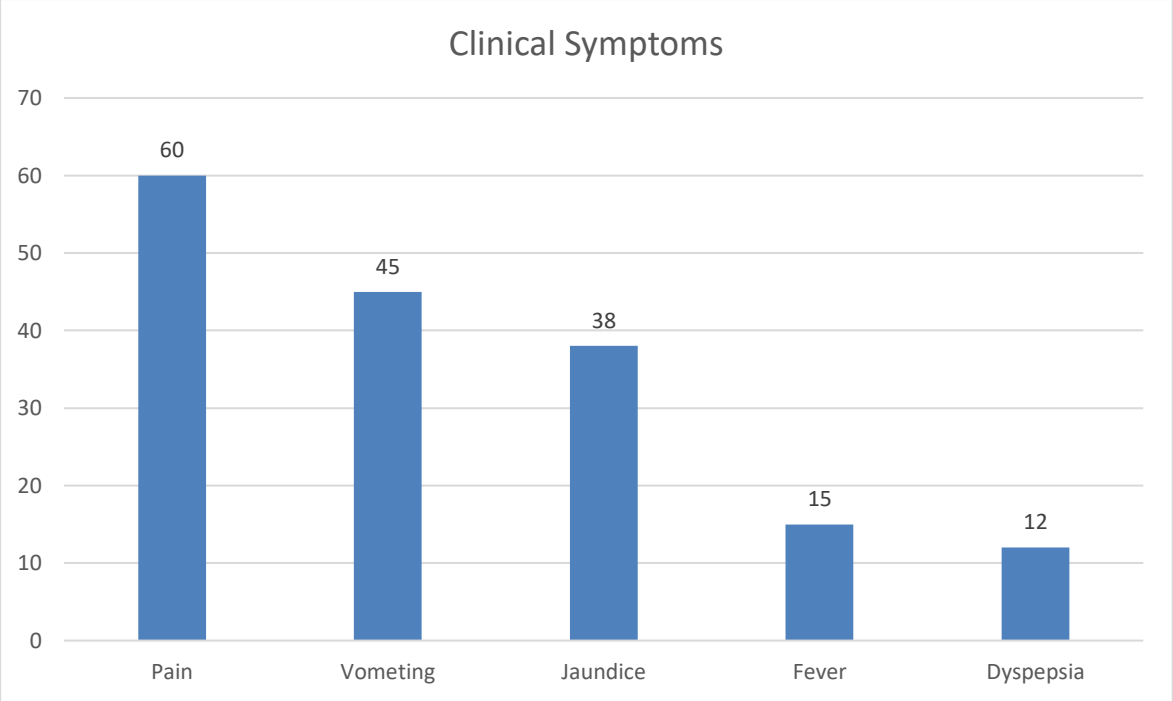
Table 3: Gender-wise cases underwent conversion (N = 94)

Gender	Laparoscopic	Conversion	Total	P value
Male	40	2	42	**0.02**
Female	47	5	52	
Total	**87**	**7**	**94**	

Table 4 assesses the clinical symptoms presented by patients undergoing laparoscopic cholecystectomy. Pain was the most common symptom reported in 60 patients, followed by vomiting in 45, jaundice in 38, fever in 15, and dyspepsia in 12 patients. Among these, dyspepsia showed a statistically significant association with surgical outcomes, with a P value of 0.04. This suggests that patients presenting dyspepsia may be at higher risk for a difficult laparoscopic cholecystectomy, while other symptoms did not show a statistically significant correlation in this analysis."

Table 4: Assessment of clinical symptoms

Clinical Symptoms	Number	P values
Dyspepsia	12	0.04
Fever	15	
Jaundice	38	
Vometing	45	
Pain	60	



Discussion

The present study of 94 patients who underwent laparoscopic cholecystectomy established some predictive factors that were significantly related to surgical difficulty and open conversion. Age distribution revealed the highest group in the age range 40–50 years, and patients aged >50 years had a significantly higher conversion rate ($p = 0.015$). This is consistent with reports such as Gupta et al. (2013), which also revealed a higher conversion rate in older patients due to reasons such as chronic inflammation, fibrosis, and co-morbidities [10]. Similarly, Kama et al. (2001) also established age >60 years as significantly related to difficult laparoscopic cholecystectomy and higher rates of conversion [11]. Nevertheless, some studies, such as Rosen et al. (2002), failed to establish age as an independent predictor when controlled for comorbidities and severity of inflammation [12], indicating that age must be considered in the general health of the patient.

Gender-wise, we observed a higher rate of conversion in females (5 out of 52) compared to males (2 out of 42) with statistical significance ($p = 0.02$). This is contrary to previous reports such as those of Joshi (2015), who observed higher rates of difficult laparoscopic cholecystectomy in males, which he found to be due to late presentation and greater fibrosis around Calot's triangle [13]. Lal et al. (2002) also observed higher conversion rates in males, particularly due to acute inflammation and more frequent history of smoking and alcohol intake [14]. Trends in the current study may be different due to local demographic variations, access to health care, or gender differential in timing of presentation and disease course.

By clinical presentation, the most frequent were pain and vomiting, and the best predictor of conversion was dyspepsia ($p = 0.04$). This finding is supported to some extent by studies such as that of Vivek et al. (2014), where atypical presentation such as dyspepsia was frequent along with chronic cholecystitis and adhesions, and access became challenging laparoscopically [15]. Most literature, however, invokes typical symptoms such as acute pain, fever, and leukocytosis as better predictors of conversion [16], implying that although dyspepsia is not widely accepted, it can be an early indicator of underlying chronic pathology that makes surgery more complicated.

In Summary, our research agrees with age and some of the symptoms, specifically dyspepsia, as predictors of difficult laparoscopic cholecystectomy and conversion. Gender observations, however, require clarification because of their variance from most of the existing literature. Multi-center studies and increased sample size in the future may distinguish these relationships and further improve predictive scoring systems.

Conclusion

This study retrospectively identified several predictive risk factors for difficult laparoscopic cholecystectomy and demonstrated statistically significant relationships between the age and gender of patients, various clinical presenting symptoms, and the chance of conversion to open surgery. Accordingly, an older age and a female gender were more common characteristics of the same group of patients requiring conversion to open surgery. Just as importantly, qualitative clinical symptoms, such as dyspepsia, also exhibited a meaningful relationship

to surgical outcomes. This study emphasizes the importance of thorough pre-operative assessment to identify potentially higher-risk patients for more complex laparoscopic procedures, which can enable effective surgical planning as well as improved outcomes for patient care.

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