

Original Research Article

# Assessment of pre-operative factors for predicting a difficult laparoscopic cholecystectomy

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**Abstract: Background:** Laparoscopic cholecystectomy (LC) is considerably gold standard for symptomatic cholelithiasis. Preoperative prediction of difficult LC and operative grading system may not only improve patient safety but also be beneficial in lessening the overall cost of therapy.

**Aim:** The present study aimed to predict and analyze risk factors using a scoring system deemed responsible for surgical difficulties in patients undergoing laparoscopic cholecystectomy (LC) for symptomatic cholelithiasis.

**Material & Methods:** This hospital based prospective study was conducted at Department of Surgery, A tertiary care teaching Hospital, central India. Various factors considered preoperatively were gender, age, previous history of hospitalization, impacted stone, obesity; gall bladder wall thickness, pericholecystic collection; previous abdominal scar and palpable gall bladder were evaluated.

**Results:** Out of 150 patients, majority of the (34.2%) was 41-50 years age group, predominantly female (62.7%). The scoring system predicted easy LC for 106(70.7%), and difficult for 44(29.3%). No significant association of difficult LC with age group, gender, BMI, h/o hospitalization with acute cholecystitis, abdominal scar, leucocytes count and Hepatic echotexture ( $P>0.05$ ), whereas palpable gall bladder, GB wall thickness, Distended gallbladder, impacted stone and pericholecystic collection were significantly associated with difficult LC.

**Conclusion:** Preoperative prediction of the factors leading to difficulty or conversion in cholecystectomy could help plan the surgical strategies and possible outcomes beforehand which can reduce the overall mortality and morbidity.

**Keywords:** Preoperative scoring system; Gallbladder difficult cholecystectomy; Laparoscopic cholecystectomy.

## 1. Introduction

**C**holecystectomy is a surgical procedure to remove the gallbladder due to stone or inflammation, and it's the most standard procedure performed in the biliary tract [1]. Laparoscopic cholecystectomy (LC) has become the preferred method and has been accepted as the gold standard for definitive management of symptomatic cholelithiasis or gallstones [2,3]. Laparoscopic cholecystectomy has many advantages over the open cholecystectomy, such as better cosmetic results, short hospital stay, minimal trauma, decreased pain, early recovery and return to physical activity and work, all have contributed to the popularity of this technique [4,5].

Multiple factors that may influence the difficulty of a cholecystectomy have been described, which may be related to the patient, such as male sex, old age, anatomical variations, previous surgeries, obesity, severe inflammation or impacted stones, thickened gall bladder wall, distended gall bladder, pericholecystic collection and external factors such as failure of inappropriate equipment [6,7].

In the early years of the laparoscopic cholecystectomy era, the conversion rate to open procedure was 2-15%. After years of learning and understanding the laparoscopic technique and increasing surgeons'

experience, the conversion rate dropped to approximately 1-6%) is conversion was an attempt to avoid complications due to various difficulties encountered during the procedure [8].

Many surgeons often face difficulties in performing LC due to their inability to precisely identify the anatomy of Calot's triangle as a result of severe inflammation. Therefore, in patients with severe acute cholecystitis (AC) the rate of complications, such as bile leakage, common bile duct injury, bleeding, visceral injury and bowel injury, is high after LC [9,10].

Most of the technical disadvantages associated with LC directly or indirectly result from the creation of pneumoperitoneum [11].

## 2. Aims & Objectives

The present study was undertaken to identify various factors associated with laparoscopic cholecystectomy that may help us in predicting or anticipating a difficult laparoscopic cholecystectomy beforehand in the pre-operative period, hence allowing the surgeon to prepare in advance for the difficulties encountered during the procedure.

## 3. Material and Methods

This prospective randomized study was conducted in the department of general surgery, in a tertiary care hospital, central India for the period of two years. The patients having symptomatic cholelithiasis willing to undergo laparoscopic cholecystectomy were enrolled in the study. Informed written consent was obtained from all patients who accepted for participation in the study.

### 3.1. Inclusion criteria

- Cases of acute or chronic cholecystitis with cholelithiasis who underwent laparoscopic cholecystectomy.
- Age > 18 years.
- Patients willingly giving consent will be included in the study.

### 3.2. Exclusion criteria

- Age below 18 years.
- Viral marker positive patients (HBs Ag, HCV, HIV).
- Pregnancy.
- Patients with common bile duct (CBD) calculus, dilated CBD.
- Patients who refused laparoscopic cholecystectomy.
- Patients who were not fit for general anesthesia due to various medical illnesses.
- Patient who didn't give informed consent.
- Contraindications to Laparoscopic cholecystectomy like: Cardiovascular and pulmonary disease, coagulopathies and end-stage liver disease (ESLD).

Diagnosis of cholelithiasis was confirmed in patients presenting with abdominal symptoms using an abdominal ultrasonography (USG).

The patients were evaluated prior to undergoing laparoscopic cholecystectomy with a detailed history and examination followed by all the relevant investigations.

The variables assessed included age, sex, body mass index, history of acute cholecystitis attacks, palpable gallbladder mass, scar tissue in the abdominal region, leukocyte count, gallbladder wall thickness, gallbladder distension, Pericholecystic collection, impacted gallstones, and changes in hepatic echotexture. Each variable assessed will be given a weight based on the Risk Scoring System for Laparoscopic Cholecystectomy. The scoring system used in this study was adapted from the scoring system published by Bhondave *et al.*, [12].

The scores for each variable are summarized in Table 1.

The assessment was divided into two categories, namely easy and difficult. The classification system was adapted from the criteria used by Bhondave *et al.*, [12]. A per operative score of 0 - 5 predicted as easy and > 5 considered as difficult.

In this study, we decided that if one of the criteria for laparoscopic cholecystectomy was difficult to fulfill, then the operation was declared difficult. The criteria for each category are summarized in Table 2.

**Table 1.** Laparoscopic cholecystectomy surgery risk Preoperative scoring system

Parameter		Score
Age group	>50 year	1
	= 50 year	0
Gender	Male	1
	Female	0
History of acute cholecystitis attack	Yes	4
	No	0
Body mass index (kg/m <sup>2</sup> )	>30	1
	= 30	0
Palpable gallbladder	Yes	1
	No	0
Abdominal scar	Yes	1
	No	0
Leukocyte count	>12000	1
	= 12000	0
Gallbladder wall thickness	>4 mm	2
	= 4 mm	0
Distended or contracted gallbladder	Yes	1
	No	0
Pericholecystic collection	Yes	1
	No	0
Impacted gallstone	Yes	1
	No	0
Changes in hepatic echotexture	Yes	2
	No	0

**Table 2.** parameters for assessment of prediction of laparoscopic cholecystectomy

Parameter	Classification
<b>These three criteria must be met:</b>	Easy
Duration of surgery = 60 minutes	
No bile acids are spilled into the surrounding tissue	
No arterial or ductal damage	Difficult
<b>There is one of the following criteria:</b>	
Duration of surgery >60 minutes	
There are bile acids that spill into the surrounding tissue	
There are arterial or ductal damages	
Duration >120 minutes	
Converted to open cholecystectomy	

**Table 3.** Preoperative characteristics of the study patients

Patient characteristic		Frequency (N=150)	Percentage (%)
Age group (in years)	<30	22	14.7%
	31-40	35	23.3%
	41-50	52	34.6%
	51-60	25	16.7%
	>60	16	10.7%
Gender	Male	56	37.3%
	Female	94	62.7%
H/o hospitalization for acute cholecystitis	Yes	41	27.3%
	No	109	72.7%
Body mass index (kg/m <sup>2</sup> )	Normal <25	7	4.7%
	Pre obese 25-29.9	60	40%
	Obese 30-34.5	66	44%
	Morbid obese >35	17	11.3%
Palpable gallbladder	Yes	28	18.7%
	No	122	81.3%
Abdominal scar	Yes	16	10.7%
	No	134	89.3%

**Table 4.** Outcome of the operation among studied cases

Category of LC	Frequency (N=150)	Percentage (%)
Easy	106	70.7%
Difficult	44	29.3%
Total	150	100%

#### 4. Statistical Analysis

In the present study, statistical analyses of data were carried out using SPSS version 22. Numerical data were expressed as mean  $\pm$  standard deviation. P value < 0.05 was considered significant.

#### 5. Results

A total of 150 patients were undergoing laparoscopic cholecystectomy included in this study. Majority of the patients (34.6%) were 41-50 years age group, predominantly female (62.7%). The mean age  $\pm$ SD of the patient was  $45.62 \pm 15.24$  years. Most of the patients 66 (44%) was obese. 41 (27.3%) patients had past history of hospitalization for acute calculus cholecystitis while 16 (10.7%) had prior history of surgery with abdominal scar mostly midline. Gall bladder was palpable clinically in 28 (18.7%) patients. Preoperative characteristics of the study patients are given in Table 3.

Most of the patients had preoperative score of 0-5 and most (70.7%) were easy. However, 44 (29.3%) of patients were labeled difficult laparoscopic cholecystectomy according to pre and intraoperative assessment. Prediction score > 5. Outcome of the operation among studied cases is given in Table 4 and predictive association of risk factors with intraoperative outcome is given in Table 5.

#### 6. Discussion

Prediction of the risk factors for laparoscopic cholecystectomy and safety of the procedure, surgeons could have benefit in deciding the surgical approach, counselling the patients, reducing the risk of complication, reducing the rate of conversion to open cholecystectomy, and reducing overall medical cost. Present study found that the most patients were in the age group of 41-50 years followed by age group of 31-40 years, our results was concordance with the Kulkarni *et al.*, [13] and Abdallah *et al.*, [14].

Majority of patients were in the age group of  $\geq 50$  years and found no significant correlation between age and the difficult laparoscopic cholecystectomy (P>0.05), accordance to the S. Baral *et al.*, [15] and Sandhu *et al.*, [16].

**Table 5.** Predictive association of risk factors with intraoperative outcome

Risk factors		Easy LC (N=106) (70.6%)	Difficult LC (N=44) (29.4%)	$\chi^2$	P value
Age group (in years)	>50	31	10	0.665	0.414
	= 50	75	34		
Gender	Male	38	18	0.340	0.559
	Female	68	26		
Body mass index (Kg/m2)	>30	60	20	1.55	0.212
	= 30	46	24		
History of cholecystitis	Yes	26	15	1.43	0.231
	No	80	29		
Abdominal scar	Yes	10	6	0.576	0.447
	No	96	38		
Palpable gallbladder	Yes	13	14	8.054	<b>0.004</b>
	No	93	30		
Leukocytes count	>12000	48	25	1.65	0.198
	= 12000	58	19		
Gallbladder wall thickness	>4 mm	46	28	5.096	<b>0.023</b>
	= 4 mm	60	16		
Distended gallbladder	Yes	7	9	6.26	<b>0.012</b>
	No	99	35		
Pericholecystic collection	Yes	9	10	5.697	<b>0.016</b>
	No	97	34		
Impacted gallstone	Yes	25	27	19.593	<b>0.001</b>
	No	81	17		
Hepatic echotexture	Yes	0	2	2.058	0.151
	No	106	42		

In this study, gender was not a significant risk factor in predicting difficult laparoscopic cholecystectomy ( $P>0.05$ ), which tolerates with studies which were conducted by N Gupta *et al.*, [17] and Buono *et al.*, [18], reported that gender did not affect the prediction of difficulty in laparoscopic cholecystectomy.

This current study declares that difficulty in LC was increase with increases in BMI and obesity but statistically not significant ( $P>0.05$ ), our finding was consistent with the Ahmed M.*et al.*, [19] and Santharaj S,*et al.*, [20].

In our study, the previous attacks of acute cholecystitis is found to be directly proportional to difficult LC but statistically not significant ( $P>0.05$ ), similar finding reported by Maehira H, *et al.*, [21] and Madan *et al.*, [22]. The repeated episodes of acute cholecystitis are associated with excessive fibrosis in GB bed that fix GB to the surroundings, making Calot's triangle frozen with difficult dissection.

No significant correlation ( $P>0.05$ ) between past abdominal surgeries (indicated by abdominal scar) and difficulties encountered during LC., concordance with the Sharma M *et al.*, [23] and Roy *et al.*, [24].

In our study we have find statistically significant association [ $p = 0.004$ ] between palpable gall bladder and difficult LC, similar finding also reported by A Iqbal *et al.*, [25] and Agrawal *et al.*, [26]. If gall bladder is palpable then it would be difficult, as there may be residual inflammation adhesion. The total leukocyte count did not show a statistically significant association ( $p>0.05$ ) with LC in the present study, accordance to the Wibowo *et al.*, [27] and Nidoni *et al.*, [28].

In this study, we had a statistically significant association of difficult LC with the thickness of the GB wall ( $P= 0.02$ ), our results are comparable with the study conducted by Giraldo *et al.*, [29] and Lal P *et al.*, [30]. The thickness of GB walls (>4 mm) may leads to difficult grasping of the GB with dense adhesions, and this added to the difficulty of procedure.

We found that impacted stone at the neck of GB is significantly associated with difficult LC ( $p<0.05$ ), same observation also reported by many other studies like Arone *et al.*, [31] and Bhardwaj R,*et al.*, [32]. Stone impacted in the neck of GB hinders grasping the GB neck during dissection; moreover, the GB is usually mucocele with difficult grasping.

We also recorded that distended GB to be significantly associated with difficult LC, which agreed with what was mentioned by Cho *et al.*, [33]. In our study significant association was seen with difficulty in laparoscopy with Pericholecystic collection ( $p<0.05$ ) which was consistent with that Hasan *et al.*, [34] and Godre *et al.*, [35].

According to a preoperative scoring method formulated by Bhondave *et al.*, [12] for predicting difficult LC, we have found prediction that 70.7% was easy and 29.3 % of difficult LC, our finding was consistent with the Paul S, *et al.*, [36] and Ahmed M *et al.*, [19].

## 7. Conclusion

The difficult laparoscopic cholecystectomy can be predicted preoperatively based on number of previous attacks of cholecystitis, gall bladder wall thickness, and presence or absence of pericholecystic collection and palpable gall bladder /or impacted stones This may be helpful to determine the risk of conversion of laparoscopic cholecystectomy to open cholecystectomy beforehand and allow patients to be better prepared for surgery. Also, such prediction may allow a surgeon to be better prepared, to take extra precautions and reduce intra-operative complications and to convert to open cholecystectomy at an earlier stage.

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**Conflicts of Interest:** "Authors declare that they do not have any conflict of interests."

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