

## Original Research Article

# Can we predict difficult laparoscopic cholecystectomy preoperatively? A comprehensive study

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### ABSTRACT

**Background:** In the study, we have tried to assess some preoperative factors (history, clinical and ultrasonographic factors) that might make the laparoscopic cholecystectomy difficult. Objective was to study the predictive scoring pattern in difficult laparoscopic cholecystectomy cases.

**Methods:** It was a prospective observational study. Ninety cases of suspected cholecystitis were identified for study presented to Jehangir hospital, Pune with upper abdominal pain or vomiting or dyspepsia or jaundice. Such patients were studied in detail clinically, admitted and investigated. Ultrasound abdomen was done in all patients.

**Results:** Out of 90 cases studied, 64 patients (71.1%) had pre op score between 0-5 i.e. easy level, 21 patients (23.3%) had pre-op score between 6-10 i.e. difficult level and 5 patients (5.6%) had pre-op score between 11-15 i.e. very difficult level against intra-op scoring of 57 patients (63.33%) being easy, 28 patients (31.1) difficult and 05 patient (5.6%) had very difficult surgery. Conversion rate in present study to open surgery was 5.6%. For predicting easy laparoscopic cholecystectomy, accuracy of preop score was 85.6% and for predicting very difficult lap cholecystectomy, accuracy of preoperative score was 95.6%.

**Conclusions:** Strongly significant factors predicting difficult laparoscopic cholecystectomy were number of hospitalisations, impacted stone and obesity. This study demonstrated that a scoring system predicting the difficulty in laparoscopic cholecystectomy is feasible and easy way. Identification of these factors preoperatively might help to psychologically prepare the patients for open surgery and for prolonged convalescence.

**Keywords:** Difficult cholecystectomy, Laparoscopic, Preoperative score

### INTRODUCTION

Cholelithiasis is a very commonly encountered biliary pathology. Increasing incidence in our country is mainly attributed to adoption of western culture and availability of sonography in both rural and urban areas. Laparoscopic cholecystectomy (LC) can be considered as benchmark of laparoscopic surgery in view of efficacy, safety and better patient tolerance.<sup>1</sup> The advantages of laparoscopic cholecystectomy over open cholecystectomy are quick recovery, minimal pain in postoperative period, minimal bowel handling, better cosmesis, reduced hospital stay. In this study, we have tried to identify few preoperative factors such as history, clinical and

ultrasonographic factors, that might predict difficult laparoscopic cholecystectomy as per Randhawa and Pujahari scoring system and other probable factors and the intraoperative factors that can make the cholecystectomy difficult.<sup>2</sup> This could help the patient as well as the surgeon in being better prepared for the intra-operative risk and the risk of conversion to open cholecystectomy.

### METHODS

Ninety cases of suspected cholecystitis presented to Jehangir Hospital, Pune were included for study presented with upper abdominal pain, or vomiting or

dyspepsia or jaundice. Such patients were studied in detail clinically, admitted and investigated. Ultrasound abdomen was done in all patients. The duration of study was from 1<sup>st</sup> March 2017 to 31<sup>st</sup> October 2018. It was a prospective observational study. Exclusion criteria being, those on whom laparoscopic cholecystectomy was performed with other laparoscopic intervention in same setting, those with laparoscopic cholecystectomy with common bile duct (CBD) exploration, those who were not willing for laparoscopic cholecystectomy surgery and patients with end stage liver disease.

We collected data prospectively and chi-square test was applied to predictors to calculate the significance of association with individual difficulty parameters.

The patients confirmed by USG examination and were evaluated with following factors: age, sex, history of previous hospitalization, BMI weight (kg)/height (m<sup>2</sup>), abdominal scar-supraumbilical or infraumbilical, palpable gall bladder, sonographic findings- wall thickness, contracted gall bladder, pericholecystic collection, impacted stone.

After admission, scoring was done on the basis of history, clinical examination and sonological findings prior to surgery as per scoring system of Randhawa and Pujari and were divided into categories of risks based on the total score.<sup>2</sup>

According to scoring, 0 points were given for age <50 years, female sex, no h/o hospitalization, BMI <25 kg/m<sup>2</sup>, no scar, no impaction/pericholecystic fluid/thin-walled gall bladder. 1 point was given for each (age >50 years, male sex, BMI 25.1-27.5 kg/m<sup>2</sup>, infraumbilical scar, palpable gall bladder, presence of pericholecystic fluid and impacted stone). 2 points were given for each BMI >27.5 kg/m<sup>2</sup>, supraumbilical scar and gall bladder wall thickness >4 mm. 4 points were given each to history of previous hospitalization. Each patient was categorised as easy (score 0-5), difficult (6-10), very difficult (11-15) and compared with intra op scoring.

For intra-op scoring, Easy laparoscopic cholecystectomy was considered when time taken for surgery was <60 minutes, no bile/stone spillage, no conversion to open and no injury to duct/artery. Difficult was considered when time taken was 60-120 minutes, presence of bile/stone spillage, with only duct injury and no conversion. Very difficult was considered when time taken was >120 minutes, with injury to both duct and artery, and conversion to open surgery.<sup>2</sup>

After that patient were taken up for laparoscopic cholecystectomy and intra-op scoring was done and it was compared to pre op scoring to see the efficacy of pre op scoring system. Laparoscopic cholecystectomies were performed using CO<sub>2</sub> pneumoperitoneum with 12 mmHg pressure and using 4 port technique 2 ports of each 5 mm and 10 mm. The timing was noted from the umbilical site

incision till the extraction of specimen. The entire cases received standard postoperative care and follow up.

### **Statistical data analysis**

The data on categorical variables is shown as n (% of cases) and the data on continuous variables is presented as Mean and Standard deviation (SD). The inter-group statistical comparison of distribution of categorical variables is done using Chi-square test or Fisher's exact probability test for 2 × 2 contingency table. The statistical agreement between two diagnostic methods is tested using Cohen-kappa technique. The diagnostic efficacy indices such as Sensitivity, specificity, PPV, NPV and accuracy are calculated for pre-operative score as a predictor of difficult laparoscopic cholecystectomy with reference to intra-operative outcome as a gold standard. All the results are shown in tabular as well as graphical format to visualize the statistically significant difference more clearly.

In the entire study, the p values less than 0.05 were considered to be statistically significant. All the hypotheses were formulated using two tailed alternatives against each null hypothesis (hypothesis of no difference). The entire data was statistically analysed using Statistical Package for Social Sciences (SPSS version 21.0, IBM Corporation, USA) for MS Windows.<sup>3-5</sup>

## **RESULTS**

### **Preoperative parameters**

Of 90 cases studied 4 had age between 21-30 years, 21 had age between 31-40 years, 37 (41.1%) had age between 41-50 years, 18 (20.0%) had age between 51-60 years and 10 (11.1%) had age between 61-70 years. The mean of age of cases studied in the study group was 46.8 years. Of 90 cases studied, 26 (28.9%) were males and 64 (71.1%) were females. The female to male sex ratio in the study group was 2.46:1.00. Of 90 cases studied, 63 (70.0%) did not have history of hospitalization and 27 (30.0%) had the history of hospitalization, out of 90 patients 54 (60.0%) had their BMI below 25.0 kg/m<sup>2</sup>, 26 (28.88%) had their BMI between 25.1-27.5 kg/m<sup>2</sup> and 10(11.1%) had BMI above 27.5 kg/m<sup>2</sup>. Of 90 cases studied, 79 (87.8%) had infraumbilical scar and 11 (12.2%) had supraumbilical scar on clinical examination. Of 90 cases studied, 55 (55.6%) did not have palpable gall bladder and 40 (44.4%) had palpable gall bladder on clinical examination, out of 90 patients 39 (43.3%) had thick gall bladder, 36 (40.0%) had thin gall bladder, 48 (53.3%) had pericholecystic fluid and 30 (33.3%) had stone impacted in neck on USG examination.

### **Preop scoring**

Of 90 cases studied, 64 (71.1%) had pre-op score between 0-5 i.e. easy level, 21 (23.3%) had pre-op score

between 6-10 i.e. difficult level and 5 (5.6%) had pre-op score between 11-15 i.e. very difficult level (Table 1).

**Table 1: Distribution of pre-operative score (Randhawa and Pujahari et al) among the cases studied.**

Pre-operative score	No. of cases	% of cases
0-5 (easy)	64	71.1
6-10 (difficult)	21	23.3
11-15 (very difficult)	5	5.6
<b>Total</b>	<b>90</b>	<b>100.0</b>

**Intra-op parameters**

Of 90 cases studied, 56 (62.2%) had time of surgery less than 60 minutes, 29 (32.2%) had time of surgery between 60-120 minutes and 5 (5.6%) had time of surgery more than 120-minutes. Of 90 cases studied, 85 (94.4%) had laparoscopic surgery and 5 (5.6%) required conversion to

open surgery. Of 90 cases studied, 11 (12.2%) had injury to artery, 17 (18.9%) had injury to duct, 5 (5.6%) had injury to both and 57 (63.3%) had no intra-op injury. Of 90 cases studied, 32 (35.6%) bile spillage 58 (64.4%) did not have bile spillage (Tables 2-4).

**Table 2: Distribution of intra-operative outcome score of difficult laparoscopic cholecystectomy among the cases studied.**

Intra-operative score	No. of cases	% of cases
Easy	57	63.3
Difficult	28	31.1
Very difficult	5	5.6
<b>Total</b>	<b>90</b>	<b>100.0</b>

Of 90 cases studied, 57 (63.3%) had intra-op score at easy level, 28 (31.1%) had intra-op score at difficult level and 5 (5.6%) had intra-op score at very difficult level.

**Table 3: Distribution of association of pre-operative score (Randhawa and Pujahari et al) with the intra-op status of difficult laparoscopic cholecystectomy among the cases studied.**

Pre-operative score	Intra-op score (gold standard)						Total (preop)	Cohen-Kappa	P value
	Easy		Difficult		Very difficult				
	n	%	n	%	n	%			
0-5 (easy)	54	94.7	9	32.1	1	20.0	64	0.625	0.001***
6-10 (difficult)	3	5.3	17	60.7	1	20.0	21		
11-15 (very difficult)	0	0.0	2	7.1	3	60.0	05		
<b>total (intra op)</b>	<b>57</b>	<b>100.0</b>	<b>28</b>	<b>100.0</b>	<b>5</b>	<b>100.0</b>			

P value by Chi-Square test. Statistical agreement is assessed by Cohen-Kappa Statistic. P value <0.05 is considered to be statistically significant agreement. \*\*\*P value<0.001.

The pre-operative score (Randhawa and Pujahari et al) is significantly associated with intra-operative score of difficult laparoscopic cholecystectomy (p value<0.001) with relatively higher Cohen Kappa value of 0.625. There is relatively higher agreement between pre-operative score and intra-operative score of difficult laparoscopic cholecystectomy.

**Table 4: The distribution of incidence of intra-operative outcome score according to pre-operative risk factors.**

Risk factor	Level	Intra-operative outcome score				P value
		Difficult/very difficult		Easy		
		n	%	n	%	
Age (years)	<50	19	30.6	43	69.4	0.007**
	>50	17	60.7	11	39.3	
Sex	Male	13	50.0	13	50.0	0.217NS
	Female	23	35.9	41	64.1	
BMI (kg/m <sup>2</sup> )	<25	12	22.2	42	77.8	0.001***
	25.1-27.0	14	53.8	12	46.2	
	>27.0	10	100.0	0	0.0	
Abdominal scar	Infraumbilical scar	29	36.7	50	63.3	0.108NS
	Supraumbilical scar	7	63.6	4	36.4	
Hospitalization	No	15	23.8	48	76.2	0.001***
	Yes	21	77.8	6	22.2	
GB palpable	No	14	28.0	36	72.0	0.009**
	Yes	22	55.0	18	45.0	
USG wall thickness	Normal	15	29.4	36	70.6	0.019*
	Thickened	21	53.8	18	46.2	

Continued.

		Intra-operative outcome score				
Impacted stone	No	13	21.7	47	78.3	0.001***
	Yes	23	76.7	7	23.3	
Pericholecystic fluid	No	12	28.6	30	71.4	0.038*
	Yes	24	50.0	24	50.0	

P value by Chi-Square test (Fisher's exact probability test for 2 x 2 contingency table). P value<0.05 is considered to be statistically significant agreement. \*P-value<0.05, \*\*P-value<0.01 highly significant, \*\*\*P value<0.001 strongly significant, NS-statistically non-significant.

## DISCUSSION

### Clinical findings

Increasing age probably because of multiple number of attacks of cholecystitis might be a risk factor for difficult cholecystectomy.<sup>6</sup> In our study we found that 60% of patients above 50 years had difficult cholecystectomy (p-0.007) which correlates the study by Paidipelly et al and Randhava et al.<sup>2,6</sup> In present study sex was not a statistically significant factor for predicting difficult cholecystectomy (p-0.217). It is consistent with observations of Schrenk et al.<sup>7</sup> In our study, it was observed that BMI>27.5 was highly predictive factor for conversion to open cholecystectomy and was significantly associated with difficult cholecystectomy which was supported by data published by Randhawa et al, Gabriel et al.<sup>2,8</sup> Number of hospitalization due to episodes of acute cholecystitis which were managed conservatively had a correlation with the difficulty level of cholecystectomy as it may lead to increased gall bladder wall thickness and cause scarring and fibrosis of gall bladder.<sup>9</sup> In the present study, we found strongly significant correlation between previous history of hospitalization and difficult laparoscopic cholecystectomy with 77% of patients who were hospitalised had difficult cholecystectomy. Liu et al and Khetan also reported previous history of acute cholecystitis as a significant predictor of difficult laparoscopic cholecystectomy.<sup>10,11</sup> In present study it was observed that there is no statistically significant correlation (p-0.108) between history of previous abdominal surgery and intraoperative difficulty. Kanaan et al and Lipman et al did not find prior abdominal surgery as a significant risk factor for conversion or prediction of difficult laparoscopic cholecystectomy and it supported our findings.<sup>12,13</sup> In our study we found that palpable gall bladder was a significant predictor for difficult laparoscopic cholecystectomy (p-0.009). The results were supported by Randhava et al and Fried gm et al.<sup>2,14</sup>

### Ultrasound findings

Gall bladder wall thickness of >4 mm was found to be an important predictor of difficult laparoscopic cholecystectomy with high statistical significance (p-0.019) which may occur because acute cholecystitis may lead to increased gall bladder wall thickness, scarring and fibrosis in and around gall bladder, making subsequent surgery difficult. Above findings correlate with the

findings of Agarwal et al.<sup>15</sup> We found statistically significant correlation (p-0.038) between presence of pericholecystic fluid and difficult cholecystectomy which was supported by study from Singh et al.<sup>16</sup> We found that out of 30 patient who had impacted stone, 23 patients (76%) turned out to be difficult cholecystectomy and impacted stone was identified as a significant predictor (p-0.001). Our study correlates with the study done by Lal et al which states that stone impacted at neck hinders holding the gall bladder during dissection making it more difficult.<sup>15</sup> Of 90 cases studied, 5 patients (5.6%) required conversion to open surgery. We did not find statistically significant correlation between preoperative score and conversion to open surgery.

There are some limitations of the study. As it was a single center study, there is a scope for further prospective study for the validation of this score with increased number of participants. There is scope for further refinement to make the same less cumbersome and easier to handle.

## CONCLUSION

For predicting difficult laparoscopic cholecystectomy sensitivity and specificity of preop score was 60.7% and 93.5% respectively. Sensitivity and specificity for very difficult cholecystectomy was 60% and 97.6% respectively. Accuracy of the present study to predict easy, difficult and very difficult laparoscopic cholecystectomy was 85.6%, 83.3% and 95.6% respectively. Strongly significant factors for predicting difficult LC were obesity, history of hospitalization (recurrent cholecystitis) and impacted stone at neck. Highly significant factors for predicting difficult laparoscopic cholecystectomy were age >50, palpable GB. Statistically significant factors for predicting difficult laparoscopic cholecystectomy were Increased GB wall thickness and pericholecystic fluid. Non-significant factors were sex of patient and abdominal scar.

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