

A Retrospective Assessment of the Predictors of Difficulty in Laparoscopic Cholecystectomy

Santosh Kumar Sharma

Assistant Professor, Department of General Surgery, NMCH, Patna, Bihar, India.

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Corresponding author: Dr. Santosh Kumar Sharma

Conflict of interest: Nil

Abstract

Aim: To develop and validate a scoring method to predict difficult and very difficult LC preoperatively.

Material & Methods: This is a retrospective study conducted in the Department of General Surgery, NMCH, Patna, Bihar, India. Patients who underwent Laparoscopic Cholecystectomy in the Tertiary Care Centre by the same surgeon involved in the study. The study involved patients who were operated over a period of 12 months (July 2019 to June 2020)

Results: Among different demographic and history related factors, the only history of hospitalization and ERCP±Stenting were significantly associated with the difficulty of the procedure ($p < 0.001$). The lone biochemical factor i.e. raised ALP, also showed a significant association with the level of difficulty ($p = 0.001$). The diagnostic accuracy of the score for the prediction of very difficult procedures was 97.1%.

Conclusion: The proposed scoring system was effective and can help diagnose preoperatively into easy, difficult and very difficult cases.

Keywords: Difficult Laparoscopic Cholecystectomy, scoring system, conversion to open cholecystectomy

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Introduction

Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic cholelithiasis due to its effectiveness, and safety. Moreover, the benefits of laparoscopic cholecystectomy are; less postoperative pain, faster recovery, earlier return of bowel function, and shorter hospital stay when compared to conventional cholecystectomy [1, 2].

Although, the LC is the most common operation performed these days, some of the intended LC require conversion due to several factors. Many a time it demands

conversion to open cholecystectomy due to intraoperative complications for the safe ending of the procedure and takes more than anticipated time. However, current literature has mentioned a conversion rate of nearly about (2%–10%) [3].

Multiple factors that may influence the difficulty of a cholecystectomy have been described, which may be related to the patient, such as age, sex, anatomical variations, previous surgeries, obesity, or may be related to pathologies such as severe inflammation or impacted stones,

external factors such as failure of inappropriate equipment or equipment may also influence [4-8]. The evaluation of this difficulty can also vary between the perception of a surgeon and another, hence the importance of using a single intraoperative difficulty scale, where intraoperative findings are described. To use one of these scales, it must be based on intraoperative findings and thus define the difficulty of laparoscopic cholecystectomy, which, regardless of the surgeon, will not change. Given the above, multiple scales such as Parkland, AAST, Cuschieri or Sugrue [9-11] have been described, another of these scales were described by Nassar et al., in 1995, which was recently validated in a study that included two prospective cohorts with a total of 12,909 patients. Intraoperative findings are standardized with the help of one of these scales [11].

The present study was needed as it may help to identify difficulties and complications in order to avoid the risk of conversion of an LC to open cholecystectomy beforehand. Such prediction may allow a surgeon to take extra precautions to reduce intra-operative complications and to convert from LC to open cholecystectomy at an earlier stage. Hence, the present study was carried out to develop a scoring system to predict difficult laparoscopic procedures and to validate it against a Randhawa and Pujahari defining laparoscopic difficulty.

Material & Methods:

This is a retrospective study conducted in the Department of General Surgery, NMCH, Patna, Bihar, India. Patients who underwent Laparoscopic Cholecystectomy in the Tertiary Care Centre by the same surgeon involved in the study. The study involved patients who were operated over a period of 12 months (July 2019 to June 2020)

Inclusion Criteria

- Age 18-60 years

- Patients found to have gall stone disease on abdominal sonography
- Operated by a single experienced surgeon

Exclusion Criteria

- Common bile duct (CBD) calculus.
- Dilated CBD.
- Features of obstructive jaundice.
- Not willing for laparoscopic cholecystectomy.
- Contraindication for Laparoscopic Cholecystectomy.

Ethical Clearance was taken from the Institute Review Board of the Tertiary Health Care Centre Data

Collection and Methodology: Medical records of 179 patients who underwent laparoscopic cholecystectomy by the same surgeon involved in the study, was collected. A quantitative tool was designed on the basis of history, examination and sonological findings to categorize into difficult and very difficult LC. Out of 179 patient records, only 100 patients fulfilled the inclusion criteria, and 79 were excluded.

The scoring system was designed by an expert panel comprising of senior surgeons. It included demographic, clinical and sonographic profiles of patients that could affect surgical decisions and could contribute to difficulty in the procedure as per previous clinical experience. The weightage / scores to different characteristics as proposed by the panel.

Out of four sections of the scoring system proposed, demographics/history had a maximum possible score of 10, the clinical section had a maximum possible score of 5, the sonographic section had a maximum possible score of 4, and the biochemical section had a maximum possible score of 2. The composite score of all these scores could reach a maximum of 21. The expert panel proposed three categories based on

this scoring system – scores 0-7, 8-14 and 15-21 respectively to designate the difficulty level. Validation of scoring system was done against the criteria for the difficulty of Laparoscopic Procedures as suggested by Randhawa and Pujahari [12] that divides the laparoscopic cholecystectomy procedures into three categories as per the criteria given below:

Statistical Analysis:

Statistical analysis was performed using SPSS version 19.0 (SPSS Inc., Chicago, IL, USA). The results were reported using descriptive statistics and graphs. Discrete (categorical) data were summarized as proportions and percentages (%). Chi-square test was used

to determine predictors of difficult and very difficult LC. ROC analysis was done to determine cut-offs for the scoring system to predict difficulty. A value of $p < 0.05$ was considered statistically significant.

Results:

A total of 100 patients were included in the study. According to modified Randhawa and Pujahari criteria. Preoperative predictive scores were 0-7, 8-14 and 15-21 in 71%, 10% and 3% patients respectively. Statistically, there was a significant association between predictive scores and level of difficulty (Table 1).

Table 1: Association between levels of difficulty of laparoscopic cholecystectomy procedures with pre-operative score

Pre-operative score category	Level of difficulty (Modified Randhawa and Pujahari criteria)			Total
	Easy	Difficult	Very Difficult	
0-7	71	10	0	81
8-14	3	10	2	15
15-21	0	1	3	4
Total	74	21	5	100

$$\chi^2=132.66 \text{ (DF=4); } p<0.001$$

Majority of cases were aged <50 years (78%) and were females (69%). History of hospitalization and ERCP +/- stenting was positive in (36%) and 19% patients, respectively. 35% had BMI <25 kg/m², 20% had BMI 25.0-27.5 kg/m² and 55% had BMI >27.5 kg/m². The presence of abdominal scar was noted in 19% cases; a total of 15% had infraumbilical scar, while 4% had a supraumbilical scar. Gall bladder palpability was seen in 25% cases. Sonographically, a total of 20% had a thick wall, 27% had a pericholecystic collection, and 15% had impacted stone. Serum ALP levels were raised in 10% cases. Among different demographic and history related factors,

the only history of hospitalization and ERCP±Stenting were significantly associated with the difficulty of the procedure ($p < 0.001$). All the three clinical factors, viz. BMI, abdominal scar and palpable gall bladder showed a statistically significant association with a difficulty level ($p < 0.05$). Among sonographic factors, wall thickness and pericholecystic collection showed a significant association with the level of difficulty ($p < 0.05$), however, the presence of impacted stone did not ($p = 0.271$). The lone biochemical factor i.e. raised ALP, also showed a significant association with the level of difficulty ($p = 0.001$) (Table 2).

Table 2: Association of outcome with different factors of pre-operative predictor score

S.N.	Factor	Outcome level of difficulty (Modified Randhawa and Pujahari criteria)			Statistical Significance	OR as compared to easy (95% CI)		
		Easy	Difficult	Very Difficult		Difficult	Very Difficult	
Demography & History								
1	Age	<50	58	18	2	$\chi^2=4.715$ p=0.261	Ref.	Ref.
		>50	14	5	3		1.41	4.65
2	Sex	Female (69)	51	15	3	$\chi^2=5.622$ p=0.681	0.79	0.82
		Male (31)	22	8	1			
3	Hospitalization	No	55	13	0	$\chi^2=2.379$ p<0.001	Ref.	Ref.
		Yes	8	21	7		24.618	NA
4	H/O ERCP + Stenting	No	61	13	7	$\chi^2=35.791$ p<0.001	Ref.	Ref.
		Yes	4	7	8		3.628	1.662
b. Clinical								
5	BMI	<25 (35)	31	3	1	$\chi^2=14.628$ P=0.001	Ref.	Ref.
		25.1-27.5 (20)	12	5	1		4.628	1.332
		>27.5 (55)	30	20	5		6.882	5.171
6	Abdominal Scarring	No (81)	63	11	7	$\chi^2= 19.603$ P=0.001	Ref.	Ref.
		Infraumbilical (15)	10	5	0		1.439	NA
		Supraumbilical (4)	1	3	1		12.518	8.371
7	Palpable gall bladder	No (75)	59	15	1	$\chi^2= 15.801$ P=0.001	Ref.	Ref.
		Yes (25)	11	10	4		3.923	5.724
c. Sonographic								
8.	Wall thickness	Thin (80)	65	13	2	$\chi^2=7.584$ P=0.05	Ref.	Ref.
		Thick (20)	15	9	1		3.686	5.892
9.	Peri-colecystic collection	No (73)	59	12	2	$\chi^2=10.279$ P=0.05	Ref.	Ref.
		Yes (27)	18	6	3		1.644	5.793
10.	Impacted stone	No (85)	70	10	5	$\chi^2= 6.709$ P=0.001	Ref.	Ref.
		Yes (15)	7	5	3		4.695	5.847
d. Biochemical								
11.	ALP	Normal (78)	68	9	1	$\chi^2= 13.612$ P=0.271	Ref.	Ref.
		Raised (22)	10	10	2		4.871	10.793

The diagnostic accuracy of the score for the prediction of difficult procedures was 86.38%. At cut-off >15, the sensitivity, specificity, positive predictive value and negative predictive value of the proposed preoperative scoring system for very

difficult procedures were found to be 70.3%, 99.6%, 82.4% and 98.3%. The diagnostic accuracy of the score for the prediction of very difficult procedures was 97.1% (Table 3)

Table 3: ROC analysis to find Validity/Reliability of the proposed scoring system

Variable	Score cut off	
	≥8	≥15
Outcome predicted	Difficult	Very Difficult
AUC	0.9	0.9
Sensitivity	65.5	70.3
Specificity	98.6	99.6
PPV	92.3	82.4
NPV	86.5	98.2
DA	88.0	97.1

Discussion:

Laparoscopy cholecystectomy is one of the most common procedures in the world. During surgeon training, this procedure is the initial procedure when you begin your training in laparoscopy; however, in some cases may be technically difficult due to the inflammatory process and adhesions [13].

When a difficult cholecystectomy occurs, the risk of bile duct injury increases by up to 10 times, increases the conversion rate, increased bleeding, more postoperative complications and longer surgical time [14].

Thickened GB wall was identified as a risk factor for conversion to OC in almost all studies and critical wall thickness differs depending on a particular study. Fried [15] and Corr [16] conclude that wall thickness of GB 3 mm and more, significantly makes dissection of the GB more difficult. Many authors note that the wall thickness of GB 4 mm, 6 mm and 7 mm or more is a factor that significantly makes the LC more difficult. In our study a thickened GB wall >4 mm was significantly related to more difficult dissection of the Calot triangle elements and the GB, which correlates to the majority of studies [17-19].

Similar to the present study, Gupta et al. [20] reported that out of 141 cases found to be easy, a total of 135 (95.7%) were predicted as easy, out of 57 cases found to be difficult, a total of 42 (73.7%) and all

the 12 cases found to be very difficult were predicted to be difficult. An evaluation of all these scoring systems showed that very difficult cases are often missed by these scoring systems.

It is important to have a tool to predict the difficulty of cholecystectomy, this to choose the best schedule to perform the procedure, have support, inform the patient of the possible difficulty and increase of complications, and select the patient for the patient's training according to the level of training [21,22].

Conclusion:

The proposed scoring system was effective and can help diagnose preoperatively into easy, difficult and very difficult cases.

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