

External Validity of Preoperative Predictive Risk Scoring System for Assessment of Difficulty in Laparoscopic Cholecystectomy at a Rural Hospital

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ABSTRACT

Background: Cholelithiasis is one of the most common problems affecting the digestive tract. Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic cholelithiasis. This procedure though mostly safe and uneventful can be difficult at times. A lot of problems can be avoided by correct preoperative prediction of difficult cholecystectomy. Many studies have attempted to create a scoring system to predict difficulty in LC. One such scoring system was devised by Randhawa and Pujahari.

Objective: The aim of our study was to ascertain the validity of this scoring system in our hospital scenario.

Materials and methods: This was a prospective study conducted at District Hospital Anantnag, a rural healthcare center located in the valley of Kashmir, India, from September 2016 to September 2018. Out of 327 patients admitted for LC were enrolled. Each patient was assigned scores preoperatively based on the history, clinical assessment, and sonographic findings as described by Randhawa and Pujahari. All intraoperative events like duration of surgery, bile stone spillage, and injury to duct/artery were recorded. Postoperatively, we defined the surgical procedure as easy, difficult, and very difficult as described by Randhawa and Pujahari.

Results: The mean age of patients in our study was 43 years. In our study, we observed that age >50 years, male sex, body mass index (BMI) >27.5, history of hospitalization for acute cholecystitis, palpable gallbladder on clinical examination, and thick wall gallbladder on sonography were statistically significant predictors of difficult LC. The sensitivity, specificity, positive predictive value and negative predictive value of this scoring system as reported by us are 86.41, 79.76, 92.51, and 67%.

Conclusion: We conclude that the scoring system of Randhawa and Pujahari for the prediction of the difficulty of LC applies to rural settings and has high sensitivity, specificity, and accuracy.

Keywords: Difficult cholecystectomy, Gall bladder, Laparoscopic cholecystectomy.

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INTRODUCTION

Cholelithiasis, a prevalent digestive tract issue with an estimated 4% occurrence in India, often prompts the adoption of laparoscopic cholecystectomy (LC) as the primary treatment modality.¹ Acknowledged as the gold standard, LC's safety and effectiveness were underscored by the National Institute of Health (NIH) in 1992, reinforcing its status as the preferred approach for symptomatic gallstones.²

The widespread adoption of laparoscopic techniques, constituting approximately 80% of cholecystectomies, has significantly improved patient outcomes.³⁻⁵ However, the journey towards a successful LC can be hindered, necessitating conversion to open surgery from 2 to 15% of cases.⁶ The challenges are diverse, ranging from congenital vascular and ductal anomalies to acute inflammation with dense adhesions in Calot's triangle. Additionally, factors such as small fibrotic, thick-walled gallbladders, and obscured anatomy in the hepatocystic triangle pose difficulties. Cholecystoenteric fistulas further complicate the surgical landscape.⁷

Recognizing the potential hurdles in LC, the importance of accurate preoperative prediction cannot be overstated. This prediction serves as a valuable tool in counseling patients, informing them about the possibility of conversion to open technique, pain

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associated with a bigger incision, surgical site infection, potential change in postoperative course, longer hospitalization, and the need for more intensive postoperative care. Moreover, surgeons can leverage this information to schedule surgeries more effectively, and hospital administrations can optimize resource allocation and bed management efficiently.^{8,9}

In the pursuit of enhancing preoperative predictions, numerous scoring systems have been proposed, with the Randhawa and Pujahari systems being one such attempt.¹⁰ The focus of our study

Table 1: Scoring factors

History			Max score
Age	<50 yr (0)	>50 yr (1)	1
Sex	Female (0)	Male (1)	1
History of hospitalization	No (0)	Yes (4)	4
BMI	<25 (0)	25–27.5 (1) >27.5 (2)	2
Abdominal scar	No (0)	Infraumbilical (1) Supraumbilical (2)	2
Palpable gallbladder	No (0)	Yes (1)	1
Wall thickness	Thin (0)	Thick >4 mm (2)	2
Pericholecystic collection	No (0)	Yes (1)	1
Impacted stone	No (0)	Yes (1)	1

lies in evaluating the validity of this scoring system within the unique context of our hospital. By systematically applying the Randhawa and Pujahari scoring criteria to our patient dataset, we aim to determine its efficacy in predicting the challenges associated with LC in our specific setting. This investigation not only contributes to the existing body of knowledge on cholecystectomy but also holds practical implications for surgical planning, patient counseling, and resource optimization within our healthcare facility.

MATERIALS AND METHODS

This prospective analytical study was conducted at District Hospital Anantnag, a rural healthcare center situated in the Kashmir Valley, India, spanning from September 2016 to September 2018. A total of 327 patients scheduled for LC were included in the study after obtaining written informed consent. Exclusion criteria comprised individuals with acute cholecystitis, choledocholithiasis, increased common bile duct diameter, bleeding diathesis, a history of jaundice or cholangitis, a cholestatic pattern of liver enzymes, age below 15 years, and those unfit for general anesthesia. Patients unwilling to participate were also excluded. The study protocol received approval from the Institutional Review Board, and adherence to the principles of the Declaration of Helsinki was maintained throughout.

The assessment of risk factors included age, sex, body mass index (BMI), history of prior hospitalization, the presence of abdominal scars, palpable gallbladder, gallbladder wall thickness, pericholecystic collection, and impacted stone. Preoperatively, each patient was assigned scores based on history, clinical assessment, and sonographic findings, following the criteria outlined by Randhawa and Pujahari,¹⁰ as detailed in Table 1.

Surgical procedures involved the use of CO₂ pneumoperitoneum with a pressure of 12 mm Hg and the use of four standard ports. The duration of surgery, occurrences such as bile or stone spillage, intraoperative bleeding, and any injuries to the duct/artery were recorded intraoperatively. Postoperatively, the difficulty of the surgical procedure was categorized as easy, difficult, or very difficult, as per the classification by Randhawa and Pujahari¹⁰ detailed in Table 2.

Data recording utilized a pre-designed proforma, and all entries were made in Microsoft Excel. The Chi-square test was employed to determine the *p*-value for differences between predictor strata, considering a *p*-value of < 0.05 as significant. Additionally, correlation coefficients along with *p*-values were calculated to assess the relationship between risk factors and the type of intraoperative difficulty.

Table 2: Criteria for easy, difficult, and very difficult cases

Easy	Time taken <60 min No bile spillage No injury to duct No injury to artery
Difficult	Time taken 60–120 min Bile/stone spillage Injury to duct No conversion
Very difficult	Time taken >120 min Conversion

Table 3: Preoperative outcomes

Risk factor	Level	Easy	Difficult	<i>p</i> -value
Age	<50 yr	163	55	0.003
	>50 yr	64	45	
Sex	Male	34	52	0.0005
	Female	193	48	
BMI	<25	197	26	0.0005
	25.1–27.5	21	47	
	>27.5	9	27	
Previous surgery	Nil	212	91	0.445
	Yes	15	9	
Hospitalization	Nil	253	65	0.0005
	Yes	28	35	
Gallbladder palpable	No	201	62	0.0005
	Yes	26	38	
Wall thickness	<3 mm	220	91	0.0005
	>3 mm	7	31	
Impacted stone	Nil	209	91	0.746
	Yes	18	9	
Pericholecystic fluid	Nil	223	67	0.410
	Yes	4	3	

RESULTS

The study encompassed a cohort of 327 patients, with a mean age of 43 years (range 16–82 years), predominantly concentrated in the age group of 31–40 years. The baseline clinical characteristics of the participants are summarized in Table 3.

The average intraoperative time was 45 ± 12.4 minutes (range 25–130 minutes), and the postoperative hospital stay averaged 1.4 ± 0.4 days. Among the 327 patients, 168 (51.37%) scored between 0 and 5, with 163 out of these 168 cases classified as easy and 5 as difficult during LC. For those with a score between 6 and 10 (147 patients), 91 were identified as having difficult LC. Notably, all 12 patients with a score exceeding 10 required conversion to open cholecystectomy, as detailed in Table 4.

Table 5 elucidates the correlation between preoperative predictions of difficulty and intraoperative assessments. This correlation exhibited statistical significance. Univariate analysis of intraoperative outcomes in relation to risk factors identified six variables (age, gender, BMI, palpable gallbladder, history of previous hospitalization, and thick gallbladder wall) that demonstrated statistical significance in the preoperative prediction of difficult LC.

Table 4: Correlation of preoperative score with difficulty level

Preoperative score	Easy	Difficult	Very difficult	Total
0–5	163	5	–	168
6–10	56	89	2	147
11–15	–	–	12	12
Total	219	94	14	327

Table 5: Correlation between preoperative and intraoperative difficulty levels

	Intraoperative easy cases	Intraoperative difficult/very difficult cases	Total	p-value
Preoperative easy case	210 (64.22%)	17 (5.19%)	227	0.0005
Preoperative difficult/very difficult cases	33 (10.9%)	67 (20.48%)	100	
Total	243 (74.3%)	84 (25.68%)	327	

DISCUSSION

Numerous studies have sought to evaluate the preoperative risk factors associated with the conversion of LC. Parameters like male sex, upper abdominal tenderness during surgery, previous upper abdominal surgery, sonographic ascertained thick gallbladder wall, age over 60 years, and a preoperative diagnosis of acute cholecystitis were identified by Kama et al., as significant factors affecting the risk of conversion through multivariate analysis.⁵ Another study by Lee et al. echoed similar findings, noting that risk factors for conversion included age over 65 years, male sex, a history of previous upper abdominal surgery, and a documented history of acute cholecystitis.¹¹

Age has consistently emerged as a significant risk factor in various studies, with higher conversion rates reported in older individuals, often using 50 years as a cutoff point.^{11,12} In the present study, age demonstrated a significant impact on intraoperative difficulty. The relationship between male sex and difficult cholecystectomy has been a subject of debate. Some literature suggests that the male gender is a risk factor for challenging cholecystectomy.^{12–14} This could be attributed to delayed diagnosis in males, as cholelithiasis is traditionally considered a predominantly female disease. Late diagnosis may result in substantial adhesions due to recurrent inflammation before detection. In our study, male sex was identified as a statistically significant predictor of difficult LC.

Obesity has been recognized as another risk factor for challenging LC. Difficulties escalate with increasing BMI due to various factors such as port placement, dissection challenges at Calot's triangle, and complications arising from instrument manipulation through a thick abdominal wall.¹⁵ Consistent with these findings, our study identified a BMI greater than 27.5 as a significant factor for predicting difficult LC.

A notable predictor of difficulty in LC is a patient's history of hospitalization due to repeated episodes of acute cholecystitis. This history may lead to increased gallbladder thickness, scarring, and fibrosis in and around the gallbladder, posing challenges in grasping and dissecting the gallbladder. Our data analysis confirmed a significantly elevated risk of difficulty and conversion in patients with a previous history of more than two attacks of acute cholecystitis, aligning with findings in other studies.^{16,17}

The presence of supra and infraumbilical scars, indicative of prior abdominal operations, has been associated with adhesions between the viscera or omentum and the abdominal wall. This increases the risk of injury during port insertion, potentially leading to conversion.^{12,13} Surprisingly, in our study, abdominal scars did not emerge as a statistically significant factor in predicting the difficulty of LC.

The clinical finding of a palpable gallbladder, often observed in patients with a distended gallbladder due to conditions such as mucocele empyema, or secondary to a thick-walled gallbladder adherent to the omentum, can pose challenges during surgery. In our study, palpable gallbladder was identified as a statistically significant predictor of difficult LC, aligning with the findings of Randhawa and Pujahari.¹⁰

The thickened gallbladder wall and a small contracted gallbladder observed during perioperative ultrasonography are direct indicators of repeated inflammatory attacks, implying a higher likelihood of fibrosis and scarring in and around the gallbladder. As anticipated, these factors were found to be statistically significant predictors of difficult LC in our study, consistent with observations in several other studies.^{6,18–22}

While pericholecystic collection has been suggested as a predictor of difficult LC in some studies,²³ our analysis did not reveal a statistically significant correlation between pericholecystic collection and difficulty in our patient population.

Inflammation around the neck of the gallbladder resulting from an impacted stone introduces technical challenges during surgery. Difficulty in grasping the gallbladder neck for adequate retraction to perform dissection at Calot's triangle can complicate the procedure. Interestingly, in our study, an impacted stone at the neck of the gallbladder did not emerge as a statistically significant factor for predicting difficult LC.

The conversion rate reported in the literature has varied widely, ranging from 7 to 35%.²⁴ Some authors have specifically associated difficult cases with a conversion rate of 25%.²⁵ In our study, the conversion rate was 12%, falling within the reported range but emphasizing the importance of acknowledging and managing potential challenges during LC.

CONCLUSION

A history of prior hospitalization for acute cholecystitis, increased gallbladder wall thickness, along with factors such as age, sex, BMI greater than 27.5, and the presence of a palpable gallbladder were identified as statistically significant predictors of difficult LC. The preoperative scoring system devised by Randhawa and Pujahari.¹⁰ demonstrated its validity in predicting difficult LC, a validation substantiated by our study. The sensitivity, specificity, positive predictive value, and negative predictive value of this scoring system, as determined in our study, were 86.41, 79.76, 92.51, and 67%, respectively.

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