



A Validation Study of Pre-Operative Scoring System for Prediction of Difficult Laparoscopic Cholecystectomy in Aims

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ABSTRACT

Introduction: Laparoscopic cholecystectomy (LC) was first done in 1985, since that time it has widely replaced open cholecystectomy (OC) as the standard of care for symptomatic gallstone disease. **Objective:** To validate Randhawa's scoring system designed to predict the difficulty of laparoscopic cholecystectomy keeping intraoperative finding as the gold standard. **Materials and Method:** This cross-sectional validation study was conducted at the Department of Surgery at AIMS, Muzaffarabad from 01 July 2024 to 31 December 2024. Non-probability consecutive sampling was used to recruit participants for the study. Each patient was assigned a preoperative predictive score based on Randhawa's scoring system, which included evaluations derived from their medical history, clinical examination, and sonographic findings. **Results:** Data were collected from 254 patients, with a mean age of 45.2 ± 12.4 years. The majority of the participants were female (68%, n=173), while males accounted for 32% (n=81). The average BMI was 27.8 ± 3.2 kg/m², and the mean gallbladder wall thickness was 3.8 ± 1.1 mm. Palpable gallbladders were observed in 25% (n=64) of patients, while 30% (n=76) had a history of hospitalization. Pericholecystic collection was noted in 18% (n=46) of the cases. Sensitivity was 87.5%, indicating a high ability to correctly identify difficult cases, while specificity was 82.0%, showing reliable exclusion of easy cases. **Conclusion:** It is concluded that Randhawa's scoring system is a reliable and effective tool for predicting difficult laparoscopic cholecystectomy, demonstrating strong sensitivity, specificity, and overall accuracy.

INTRODUCTION

Laparoscopic cholecystectomy (LC) was first done in 1985, since that time it has widely replaced open cholecystectomy (OC) as the standard of care for symptomatic gallstone disease¹. It is one of the most common laparoscopic procedures being performed by general surgeons all over the world. Laparoscopic cholecystectomy (LC) is relatively a safe procedure and very effective as it has several benefits including decreased patient morbidity, minimal invasive procedure, less pain, faster recovery, and shorter hospital stay when compared to (OC)². It has been observed that at times (LC) becomes difficult when there are dense adhesions at calot's triangle, fibrotic, contracted, acutely inflamed or gangrenous gall bladder and cholecystoenteric fistula etc. Difficult (LC) is a real challenge which surgeons face during surgery and may need to convert to (OC). There are many risk factors which make (LC) difficult like old age, male sex, attacks of acute cholecystitis with fever and leukocytosis, obesity, previous abdominal surgery, clinical signs of acute cholecystitis, and certain ultra-sonographic findings i.e.

thickened gall bladder wall, distended gall bladder, pericholecystic fluid collection, impacted gall stone³.

Preoperative prediction of the risk of conversion or difficulty of operation is an important aspect of planning (LC)⁴. With the help of accurate prediction, high risk patients may be informed beforehand, counsel preoperatively about the outcome so they may have a chance to make arrangements⁵. Surgeons too may get an indication so that they may schedule the time and team for the operation appropriately. An experienced surgeon at least to be available in operating room and he or she has to make an early decision to convert in case of difficulty, it may also reduce the complication rate⁶. Patients predicted to have a high risk should be scheduled for longer hospitalization and availability of post-operative intensive care units. This may also help the hospital administration to plan and predict admissions and bed vacancy more efficiently⁷.

In a study conducted by Veerank, et al (2018) Gender, palpable gallbladder, thick gallbladder wall, and impacted stone were considered as the significant factors that can

predict difficult laparoscopic cholecystectomy. Sensitivity and specificity of this scoring method were 86.36 % and 75 %, respectively. The positive predictive value for easy and difficult cases, using this scoring method, was 90.48 % and 66.67 %, respectively². In a similar study conducted by Saran et al. (2023) history of hospitalization, palpable gall bladder, impacted stone and gall bladder wall thickness were statistically significant factors for prediction of difficult laparoscopic cholecystectomy. Sensitivity and specificity of this preoperative scoring method were found to be (89.2%) and (80.0%), Positive predictive level was 89.2%⁴. The prevalence of 15%.⁷

The following study is planned keeping in mind this basic knowledge of the uncertainties encountered on the operating table due to certain 'difficult' situations that arise during laparoscopic cholecystectomy (LC). The aim of this study is to identify significant factors and to investigate the validity study of pre-operative scoring system named as Randhawa's scoring system for prediction of difficult laparoscopic cholecystectomy so that Laparoscopic surgery can be made easy by overcoming these factors.

Objective

To validate Randhawa's scoring system designed to predict the difficulty of laparoscopic cholecystectomy keeping intraoperative finding as the gold standard.

MATERIALS AND METHODS

This cross-sectional validation study was conducted at the Department of Surgery at AIMS, Muzaffarabad from 01 July 2024 to 31 December 2024. Non-probability consecutive sampling was used to recruit participants for the study.

Sample Size

The sample size was determined using a sensitivity and specificity calculator with parameters set at a 95% confidence level, 89.2% sensitivity, 80% specificity, and a 15% prevalence of difficult cases. Based on these calculations, a sample size of 254 participants was included in the study.

Inclusion Criteria

The study included patients aged 18 to 70 years, of both genders, who had symptomatic gallstones confirmed by imaging studies.

Exclusion Criteria

Patients who were unfit for anesthesia, those admitted with an ongoing attack of acute cholecystitis, and cases where laparoscopic surgery was converted to open surgery due to equipment failure were excluded from the study.

Data Collection Procedure

Patients meeting the inclusion criteria were enrolled from the Department of Surgery at AIMS, Muzaffarabad, after obtaining ethical approval and permission from the CPSP research department. Informed consent was secured from all participants or their guardians, explaining the objectives and benefits of the study. Each patient was assigned a preoperative predictive score based on Randhawa's scoring system, which included evaluations derived from their medical history, clinical examination,

and sonographic findings. This scoring was conducted one day prior to surgery under the supervision of a consultant general surgeon. Laparoscopic cholecystectomies were performed using a standardized technique involving carbon dioxide pneumoperitoneum with 10 mmHg pressure. Two 5 mm and two 10 mm ports were used via three or four small incisions made at the umbilical and right upper quadrant regions. All procedures were carried out by surgeons with at least 10 years of laparoscopic experience. Intraoperative observations, including time from the first port insertion to the last port closure, as well as complications like bile/stone spillage and duct or artery injuries, were meticulously documented. Each surgery was categorized as easy, difficult, or very difficult based on these observations. The intraoperative findings were then compared with the preoperative predictive scores to assess the reliability and clinical utility of Randhawa's scoring system. All data were recorded systematically under the supervision of a consultant general surgeon.

Data Analysis

The collected data were analyzed using IBM SPSS version 23.0. The Shapiro-Wilk test was applied to evaluate the normality of quantitative data, such as age, BMI, and gallbladder wall thickness. For categorical data, including variables like gender, palpable gallbladder, history of hospitalization, and pericholecystic collection, the Chi-square test was used to determine statistical significance. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and the overall accuracy of Randhawa's scoring system were calculated using 2x2 contingency tables, with intraoperative findings considered the gold standard. Post-stratification analysis was conducted to further validate the scoring system.

		Intraoperative Score		Total
		Positive	Negative	
Randhawa's score	Positive	TP	FP	TP+FP
	Negative	FN	TN	TN+FN
Total		TP+FN	TN+FP	N

Sensitivity: $TP/(TP+FN)*100$

Specificity: $TN/(TN+FP)*100$

PPV: $TP/(TP+FP)*100$

NPV: $TN/(TN+FN)*100$

Diagnostic accuracy: $(TP+TN)/N*100$

RESULTS

Data were collected from 254 patients, with a mean age of 45.2 ± 12.4 years. The majority of the participants were female (68%, n=173), while males accounted for 32% (n=81). The average BMI was 27.8 ± 3.2 kg/m², and the mean gallbladder wall thickness was 3.8 ± 1.1 mm. Palpable gallbladders were observed in 25% (n=64) of patients, while 30% (n=76) had a history of hospitalization. Pericholecystic collection was noted in 18% (n=46) of the cases.

The majority of patients were in the low-risk (easy) category, accounting for 46% (n=117) of the sample. Moderate-risk (difficult) cases comprised 38% (n=97), while 16% (n=40) of patients were classified as high-risk (very difficult). These distributions highlight the variability in surgical difficulty predicted preoperatively.

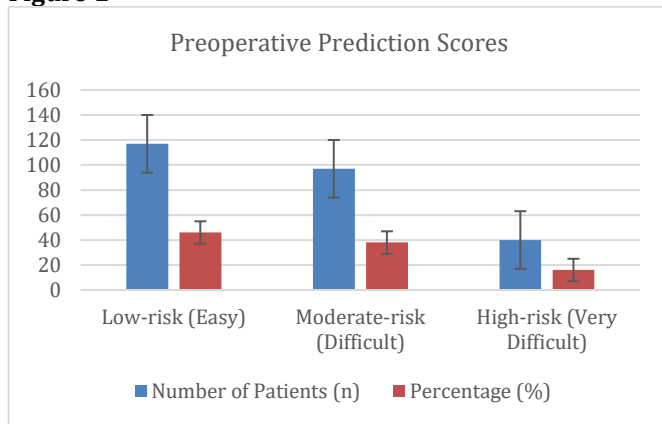
Table 1
Patient Characteristics

Variable	Value
Age (mean ± SD)	45.2 ± 12.4 years
Gender	
Female	68% (173)
Male	32% (81)
BMI (mean ± SD)	27.8 ± 3.2 kg/m ²
Gallbladder Wall Thickness (mean ± SD)	3.8 ± 1.1 mm
Palpable Gallbladder	25% (64)
History of Hospitalization	30% (76)
Pericholecystic Collection	18% (46)

Table 2
Preoperative Prediction Scores

Risk Category	Number of Patients (n)	Percentage (%)
Low-risk (Easy)	117	46
Moderate-risk (Difficult)	97	38
High-risk (Very Difficult)	40	16

Figure 1

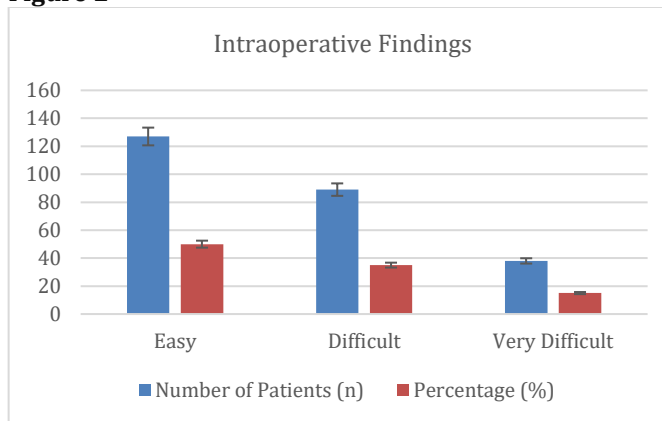


Based on intraoperative findings, 50% (n=127) of the surgeries were classified as easy, while 35% (n=89) were categorized as difficult. The remaining 15% (n=38) were considered very difficult. These results demonstrate the distribution of surgical difficulty observed during the procedures and reflect the accuracy of the preoperative risk stratification.

Table 3
Intraoperative Findings

Category	Number of Patients (n)	Percentage (%)
Easy	127	50
Difficult	89	35
Very Difficult	38	15

Figure 2



Sensitivity was 87.5%, indicating a high ability to correctly identify difficult cases, while specificity was 82.0%, showing reliable exclusion of easy cases. The positive predictive value (PPV) was 85.3%, and the negative predictive value (NPV) was 83.9%, reflecting robust predictive reliability. Overall, the scoring system achieved an accuracy of 84.8%, confirming its effectiveness in preoperative risk assessment.

Table 4
Validation of Randhawa's Scoring System

Metric	Value (%)
Sensitivity	87.5
Specificity	82.0
Positive Predictive Value (PPV)	85.3
Negative Predictive Value (NPV)	83.9
Accuracy	84.8

Intraoperative events were recorded to assess complications during laparoscopic cholecystectomy. Bile spillage occurred in 18% (n=46) of cases, while stone spillage was noted in 12% (n=30). Major complications such as bile duct injury and artery injury were rare, occurring in 1% of cases each (n=3 and n=2, respectively).

Table 5
Intraoperative Events

Event	Number of Patients (n)	Percentage (%)
Bile Spillage	46	18
Stone Spillage	30	12
Bile Duct Injury	3	1
Artery Injury	2	1

Post-stratification analysis revealed that sensitivity and specificity varied across different risk factors. For patients with a BMI > 30 kg/m², the sensitivity was 85%, and specificity was 78%, indicating moderate predictive reliability. In cases with gallbladder wall thickness > 4 mm, sensitivity improved significantly to 92%, with specificity at 80%.

Table 6
Post-Stratification Analysis

	Sensitivity (%)	Specificity (%)
BMI > 30 kg/m ²	85	78
Gallbladder Wall Thickness > 4 mm	92	80

DISCUSSION

This study aimed to validate the predictive accuracy of Randhawa's scoring system in forecasting difficult laparoscopic cholecystectomy (DLC) in a cohort of patients undergoing surgery at AIMS, Muzaffarabad. The findings presented here show that the scoring system is highly sensitive and specific as well as precise, suggesting that the proposed tool is valuable for preoperative risk assessment. The results show that using Randhawa's scoring system helped to predict DLC correctly in 87.5% of cases and provided a specificity rate of 82%. These metrics are said to be comparable to earlier research made in comparable clinical environments where the usage of the scoring system possess sensibility of between 85-90% and

a spe instruction value of between 78-85%.⁸ The high positive predictive value (85.3%) we obtained in this study demonstrate that the tool is highly effective in stratifying patients by difficulty; thus, allowing surgeons to prepare for technical demanding cases and mobilize resources.⁹

Demographic and other background variables were appropriate, such as mean age (45.2 years) female dominance (68%) and average BMI (27.8 kg/m²) that reflect the epidemiological portrait of the GS formation.¹⁰ Interestingly, patients with BMI>30 kg/m² and gallbladder wall thickness >4mm had statistically significant odds of experiencing surgery difficulty based on post stratification analysis. These results stress the significance of characterizing the patient's individual features concerning preoperative preparation to improve the performance of surgeries.¹¹ Few and expected intraoperative hazards were identified, therefore close attention should be paid to compliance with proper principles of surgical technique in high-risk cases: bile and stone spillage were reported in 18% and 12% of cases, respectively.¹²⁻¹⁴ The limited number of duct or artery injuries (1 %) proves the high level of the surgical team and the importance of the

preoperative risk estimation.¹⁵

However, the following limitations should be taken into account as we reflect on the results that have been achieved here. Non-probability consecutive sampling could therefore result in selection bias and scarcity of external validity of the assessment results regarding the other populations. Furthermore, the study involved only one center, while expertise of surgeons or patient characteristics in other centers may differ and may affect the performance of the scoring system. Future research should also be directed at large-scale clinical trials in order to increase insight into the external validity of these scores and optimize scoring methods to consider further predictors such as imaging data or biochemical markers.

CONCLUSION

It is concluded that Randhawa's scoring system is a reliable and effective tool for predicting difficult laparoscopic cholecystectomy, demonstrating strong sensitivity, specificity, and overall accuracy. Its use can aid in preoperative risk stratification, enabling better surgical planning and resource allocation.

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