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Prediction of difficult laparoscopic Cholecystectomy Using a Preoperative Scoring System: A Prospective Study from a tertiary care center in South India

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Abstract

Background: Laparoscopic cholecystectomy (LC) is the standard of care for symptomatic gallbladder disease. However, certain cases pose intraoperative challenges necessitating conversion to open surgery and certain cases ending in intraoperative and postoperative complications. A reliable preoperative scoring system can improve surgical planning and predict outcomes [7 8 11].

Methods: This prospective study was conducted between January 2021 and June 2022 at Government Thoothukudi Medical College, Tamil Nadu, South India. Sixty patients aged 18–60 years undergoing LC were assessed preoperatively using Randhawa's scoring system[7]. Intraoperative difficulty was classified based on operative time, complications, and conversion status. Data were statistically analyzed to determine predictive accuracy [6 9].

Results: Among 60 patients, 22 (36.7%) experienced difficult Laparoscopic Cholecystectomy. History of acute cholecystitis and higher BMI significantly correlated with difficulty ($p < 0.001$). Randhawa's score >4.5 predicted difficulty with 90.91% sensitivity and 100% specificity [1 2].

Conclusion: Randhawa's score reliably predicts difficult LC, improving surgical planning and outcomes [7 2 3].

Keywords: Laparoscopic Cholecystectomy, Difficult Gallbladder Surgery, Randhawa Scoring System, Surgical Decision-Making.

Introduction

It was 1882 and the first open cholecystectomy was Performed in Germany by Karl Langenbuch. The world's

first laparoscopic cholecystectomy was performed by Eric Muhe in Germany in 1985.Cholecystectomy has evolved over time with the invention of laparoscopic surgery, laparoscopic single port cholecystectomy, and robotic-assisted cholecystectomy. Common gallbladder diseases include cholelithiasis, acute cholecystitis (calculous and acalculous), and gallbladder polyps, with cholelithiasis being the most common, with a prevalence of approximately 10-15%.

Laparoscopic cholecystectomy is now universally recognized as the gold standard for the treatment of symptomatic gallbladder disease due to its minimally invasive approach, shorter recovery time, and reduced morbidity compared to open surgery. Laparoscopic cholecystectomy maintains better immune function compared to open cholecystectomy and the inflammatory response is greatly reduced. It is also mandatory for the surgery to be performed in advanced surgical centers with intensive care professionals, interventional radiologists, and importantly having operative theaters well-equipped with advanced laparoscopic equipment.

Cholecystectomy can be made difficult by processes that either obscure normal biliary anatomy (eg, acute or chronic inflammation) or operative exposure (eg, obesity or prior upper abdominal surgery)[21] , certain anatomical and pathological variations, especially those stemming from recurrent inflammation or prior interventions, can complicate what is otherwise a routine surgical procedure, The most dreaded complication of LC is iatrogenic bile duct injury (BDI) which is usually attributed to the disturbed anatomy of the region caused by the florid inflammatory process of the gallbladder, 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. These complexities may prolong operative time, increase the risk of conversion to open surgery. Current literature has mentioned a conversion rate of nearly about (2%–10%).

Difficult gallbladder (DGB) in laparoscopic cholecystectomy is a surgically risky procedure compared to standard laparoscopic cholecystectomy, with difficult anatomy, anatomical changes, and Associated with an increased risk of bleeding. There are few absolute contraindications to laparoscopic cholecystectomy. This includes patients who cannot tolerate general anesthesia, patients with suspected or confirmed gallbladder malignancy, and patients with peritonitis. To enhance surgical preparedness and improve outcomes, the ability to predict difficult cases preoperatively has become increasingly important. Among the several scoring systems proposed, the Randhawa scoring system stands out for its practicality and incorporation of routinely available clinical and Ultrasonographic parameters. This study was designed to prospectively evaluate the accuracy and clinical relevance of the Randhawa scoring system in predicting difficult laparoscopic cholecystectomy within a tertiary care context in South India.

Materials and Methods

This prospective study was conducted from January 2021 to June 2022 at Government Thoothukudi Medical College, Tamil Nadu, South India. Sixty patients aged 18–60 years undergoing elective LC for cholelithiasis, polyps, acute cholecystitis, chronic or acalculous cholecystitis and excluded those patients <18 or >60, those unfit for anesthesia or who refused consent,

underwent emergency LC for cholelithiasis with acute cholecystitis.

We divided the patients into two groups based on operative findings of difficult LC; difficult LC group and non-difficult group. We defined difficult LC as those comprising an operative time of more than ninety minutes, need for conversion to open cholecystectomy, significant bleeding (any hemorrhage that couldn't be managed with manual pressure and cautery and had to be managed with conversion into open surgeries) and those with vascular and biliary injuries.

Patients were scored using Randhawa's criteria (table 1) preoperatively which included history, clinical examination and ultrasonographic findings. Based on intraoperative findings they were stratified as easy or difficult intraoperatively [7 2 5 13].

ROC analysis evaluated the scoring system's accuracy [3, 4]. Randhawa's scoring system was used to assess the likelihood of a difficult laparoscopic cholecystectomy. The scoring criteria are outlined in the table below:

Table 1: Randhawa Scoring System for Predicting Difficult Laparoscopic Cholecystectomy

Parameter	Criteria	Score
Age	> 50 years	1
Gender	Male	1
History of Hospitalization for Acute Cholecystitis	Yes	4
BMI (Body Mass Index)	25–27.5	1
BMI (Body Mass Index)	> 27.5	2
Abdominal Scar Location	Infraumbilical	1
Abdominal Scar Location	Supraumbilical	2
Palpable Gallbladder	Present	1
Gallbladder Wall Thickness	Thickened	2
Pericholecystic Fluid	Present	1
Impacted Stone in Hartmann's Pouch	Present	1

Results

A total of 60 patients who underwent laparoscopic cholecystectomy (22 patients with difficult and 38 patients without difficult LC) (table 3 and chart 1) were studied during this period. There was female predominance with 41 (68.3%) females and 19 (31.7%) males (table 2). Mean age was 49.77 +/- 9.44 years with a range of 22 to 60 years (table 3).

Table 2: Age distribution

AGE GROUP	Frequency	Percentage
<30	7	11.7%
31-40	11	18.3%
41-50	13	21.7%
51-60	29	48.3%
Total	60	100.0%

Table 3: Gender distribution

SEX	Frequency	Percentage
Female	41	68.3%
Male	19	31.7%
Total	60	100.0%

In our study population of 60 patients, 36.7% experienced intraoperative difficulty. A Randhawa score >4.5 (Table 4) showed a diagnostic accuracy of 96.67%, with sensitivity and specificity of 90.91% and 100%, respectively. The area under the ROC curve (AUC) (figure 1) was 0.986, signifying excellent predictive power [14]. A total score greater than 4.5 was considered predictive of a difficult laparoscopic cholecystectomy.

Table 4: Randhawa's scoring system VS level of difficulty

		OPERATIVE DIFFICULTY		Total
		DIFFICULT	EASY	
RANDHAWA'S SCORING	>4.5	20	0	20
	<4.5	2	38	40
Total		22	38	60

Chart 1: Randhawa's scoring system VS level of difficulty

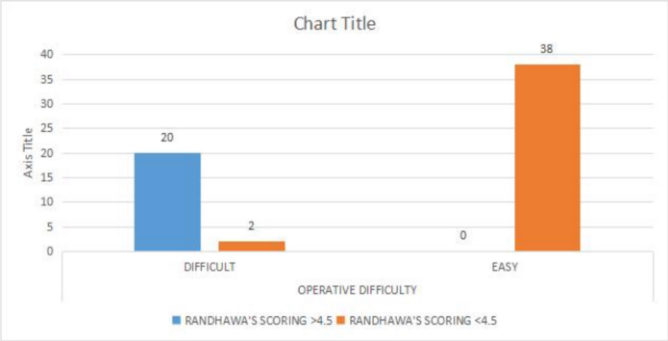
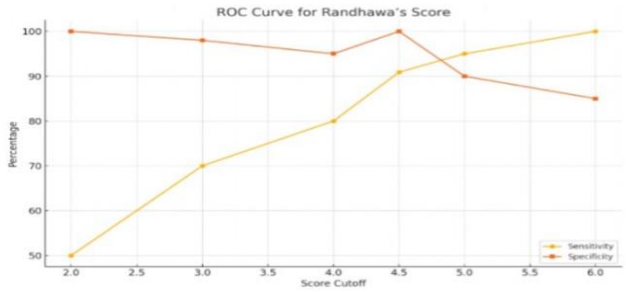


Figure 1: ROC Curve Illustrating Predictive Accuracy of Randhawa's Score



Conversion to open surgery occurred in 10% of cases [17], aligning with conversion rates reported in previous Indian and international studies. Patients who experienced conversion or significant intraoperative difficulty predominantly had higher preoperative scores, validating the utility of the scoring model.

Aiming to identify predictors of difficult laparoscopic cholecystectomy, subgroup analyzes were performed by classifying patients into difficult versus easy cholecystectomy groups based on intraoperative findings.

When evaluating the role of BMI as a risk factor, we found that BMI >25 underwent difficult laparoscopic cholecystectomy with statistical significance for BMI as a risk factor was found [p-value <0.001] (table 5).

When gender was assessed as a risk factor, 10 (52.6%) men of 19 underwent difficult laparoscopic cholecystectomy compared with 12 (29.3%) women of 41. Numerically males appeared to be a risk factor for difficult laparoscopic cholecystectomy, but was not statistically significant [p-value >0.05] (table 6).

Previous history of hospitalization for acute cholecystitis emerged as one of the risk factors, with 14 (82.4%) of 22 patients undergoing difficult laparoscopic cholecystectomy. This was statistically significant with a p value < 0.001(table 7).

A history of previous abdominal surgeries was queried, and the presence of abdominal scars was investigated and documented during examination, documented in 16 patients. Of these, 9 underwent difficult laparoscopic cholecystectomy. However, this previous history of abdominal surgery was not a predictor of difficult laparoscopic cholecystectomy [p-value > 0.05].

When patients were evaluated using imaging technology, 16 (26.7%) patients had a thickened gallbladder, a sign of chronic cholecystitis. Hartmann's pouch impaction was observed in 1 (1.7%).

Therefore, subgroup analysis summarized higher risk in males, patients with BMI >25, and those with a history of acute cholecystitis. These associations were statistically significant and highlight the need for personalized risk assessment prior to surgery.

Table 5: BMI vs level of difficulty

	OPERATIVE DIFFICULTY				
	DIFFICULT		EASY		
	Mean	Standard Deviation	Mean	Standard Deviation	P value
BMI	25.17	1.27	24.12	0.97	<0.0001 SIGNIFICANT

Table 6: Gender vs level of difficulty

			OPERATIVE DIFFICULTY		Total	P value
			DIFFICULT	EASY		
SEX	Female	Count	12	29	41	0.081 NON SIGNIFICANT
		% within SEX	29.3%	70.7%	100.0%	
	Male	Count	10	9	19	
		% within SEX	52.6%	47.4%	100.0%	
Total		Count	22	38	60	
		% within SEX	36.7%	63.3%	100.0%	

Table 7: History of previous acute cholecystitis vs Level of difficulty

			OPERATIVE DIFFICULTY		Total	P value
			DIFFICULT	EASY		
History of hospitalization for acute cholecystitis	NO	Count	8	35	43	<0.0001 SIGNIFICANT
		% within History of hospitalization for acute cholecystitis	18.6%	81.4%	100.0%	
	YES	Count	14	3	17	
		% within History of hospitalization for acute cholecystitis	82.4%	17.6%	100.0%	
Total		Count	22	38	60	
		% within History of hospitalization for acute cholecystitis	36.7%	63.3%	100.0%	

Discussion

There had been many published studies to identify several factors that were significant on the difficulty of LC. Several meta-analysis studies had also reported several factors on conversion to open surgery. Randhawa's model, as given in Table 1, was one of the preferable and practical scoring systems. It was simple using preoperative information, not including operative finding, then suitable to apply preoperatively. A total score greater than 4.5 was considered predictive of a difficult laparoscopic cholecystectomy.

Our findings strongly reinforce the clinical applicability of Randhawa's scoring system in predicting intraoperative difficulty during laparoscopic cholecystectomy. The high sensitivity and specificity of the system in our study align with previously reported data, underscoring its value as a simple and effective risk stratification tool. This predictive ability is especially crucial in resource-limited settings [20] where preoperative identification of high-risk cases can guide surgical planning [19] and improve outcomes.

Notably, subgroup analysis among various parameters of the score demonstrated its effectiveness across varied patient demographics, including BMI and previous history of acute cholecystitis which stands out as the most significant factor in predicting a difficult cholecystectomy.

The identification of dense adhesions, thick gallbladder walls, and previous hospitalizations for acute cholecystitis as significant predictors aligns with established pathophysiological reasoning—recurrent inflammation leads to fibrosis and distorted anatomy [18], making laparoscopic dissection challenging [15].

Our study also contributes to the growing body of evidence suggesting the need for tailored surgical preparedness based on preoperative scoring. It promotes more informed surgical consent, improved Operative room scheduling[16], and the possible involvement of more experienced surgeons in complex cases.

Conclusion

Laparoscopic cholecystectomy offers a minimally invasive technique with much less morbidity and better postoperative recovery. Moreover, it provides a good exposure of the operative field for GB surgery. On the contrary, lacking of tactile sensation and bidimensional vision are considered as obstacles, especially in difficult cases.

Open surgical procedure has advantage over laparoscopic technique, especially in difficult cases, as it allows surgeons to experience better tactile feedback, have a wide range of exposure and movements, and also there is no restricted number of instruments in the operative field. Preoperative identification of patient with considerable difficulties that lead to conversion could decrease the drastic outcomes of prolonged surgical procedure through decreasing the period of the trial of laparoscopic dissection.

Randhawa's scoring system is a powerful tool for predicting the difficulty of laparoscopic cholecystectomy. Its simplicity, accuracy, and reliance on routinely available clinical and sonographic data make it highly practical for surgical teams. The system

not only enhances preoperative planning but also improves communication with patients regarding potential risks.

Prediction of a difficult technique might permit the treating surgeon to discuss the probability of conversion with the patients and prepare them and helps making plans for suitable technique. Another advantage might be to allow more efficient scheduling of the operating lists and ensuring the availability of a more skilled surgeon for surgical procedure. Given its performance in our study, we recommend integrating Randhawa's score into routine preoperative evaluation protocols, particularly in training institutions and resource-limited environments. Further multicentric studies with larger populations will strengthen the evidence base for broader adoption.

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