ORIGINAL ARTICLE

Preoperative Prediction of difficult Laparoscopic Cholecystectomy using Randhawa and Pujahari Scoring System for Acute Cholecystitis, the Optimal Time for Surgery

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Abstract

Background: ***In chronic calculous cholecystitis and acute calculous cholecystitis, laparoscopic cholecystectomy (LC) is the surgical treatment of choice for gallstone symptoms. However, for a variety of reasons, some patients need to be converted to open surgery. Predicting "difficult laparoscopic cholecystectomy" in advance of surgery during acute attacks could help improve patient safety and lower therapy costs.***

Aim and objectives: ***In order to determine how well the Randhawa and Pujahari preoperative grading system predicts challenging laparoscopic procedures for patients with acute cholecystitis.***

Subjects and methods: ***The general surgery department at Al-Azhar University Hospitals undertook prospective observational research. From November 2023 to December 2024, 30 patients with acute cholecystitis underwent LC at the Cairo Fatemic hospitals. Based on the patient's history, physical exam, and radiological findings, a scoring system developed by Randhawa and Pujahari was assigned the day prior to the procedure.***

Results: ***The Kruskal-Wallis test showed a statistically significant relationship between the intraoperative difficulty evaluation and the preoperative difficulty score, with a mean of 2.4±1.4 for easy status and 6.6±3.4 for difficult status, and a p-value of 0.001 for both.***

Conclusion: ***Acute cholecystitis LC difficulty can be assessed using the valid Ranhawa and Pujahari rating system.***

Keywords: Acute cholecystitis; Laparoscopic cholecystectomy; Pujahari score; Randhawa score

1. Introduction

Cholecystectomy is the gold standard for the treatment of symptomatic cholecystitis caused by gallstones. The traditional open cholecystectomy has given way to laparoscopic cholecystectomy (LC), which is now considered the best method for treating gallstones. It might be challenging and reveal intraoperative issues at times.

Factors that increase the difficulty of laparoscopic surgery include being male, being elderly, being overweight, having acute cholecystitis attacks, having had prior abdominal surgery, and specific ultrasonographic findings such as a thickened GB wall, an enlarged GB, pericholecystic fluid accumulation, and an impacted stone.[1]

At first, LC's scoring system relied on the footage that had already been recorded. A rating system had to be put in place to alert high-risk groups before operations so that they could take the necessary precautions. Consequently, many scoring systems have been created to aid in the prediction of potential difficulties and risks during operations. For example, there is the RSCLO score, the Randhawa and Pujahari score, and the ultrasound scoring system.[2]

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The first LC procedures were performed in 1987, and since then, patients have reaped numerous benefits, especially when compared with open cholecystectomy.[3]

When compared to open cholecystectomy, the patient experiences a shorter hospital stay, lower morbidity, and better cosmetic LC. Biochemical and physiological responses are unaffected or barely altered; nevertheless, the increased risk of bile duct damage is the main drawback of the LC.[4]

In cases of acute cholecystitis, this study set out to assess how well the preoperative rating system developed by Randhawa and Pujahari predicted the likelihood of complicated laparoscopic procedures (LC).

2. Patients and methods

From November 2023 through December 2024, thirty patients receiving laparoscopic cholecystectomy surgery were enrolled in this prospective observational study at Cairo Fatemic Hospital, which is part of Al-Azhar University Hospitals. Based on the patient's history, physical exam, and radiological findings, a scoring system developed by Randhawa and Pujahari was assigned the day prior to the procedure.

Inclusion criteria:

Acute cholecystitis symptoms in adults aged 20 years and older or younger than 60 years. According to the grading method, each patient can be assigned a degree of cholecystitis based on their medical history, physical exam, and sonographic findings (Table 1).

Table (1): Pujahari and Randhawa grading scheme. [5]

HISTORY			MAX SCORE
AGE	<50 (0)	>50 (1)	1
GENDER	Female (0)	Male (1)	1
HISTORY OF HOSPITALIZATION	No (0)	Yes (4)	4
BMI	<25(0)	25-27(1) >27(2)	2
MURPHYS SIGN	Absent (0)	Positive (1)	1
ABDOMINAL SCAR	Absent (0)	Infraumbilical (1) Supraumbilical (2)	2
SONOGRAPHY			
IMPACTED STONE	No (0)	Yes (1)	1
WALL THICKNESS	Thin (0)	4mm (2)	2
PERICHOLECYSTIC COLLECTION	NO (0)	YES (1)	1

Exclusion criteria:

Obstructive jaundice, perforated gall bladder, biliary peritonitis, ascending cholangitis, acute pancreatitis, peptic ulcer patients, hepatobilliary and GIT malignancy, chronic liver disease, and pregnancy.

Methodology in detail:

Rapid hospital admission for early laparoscopic cholecystectomy (ELC) is required for patients diagnosed with acute cholecystitis based on clinical and sonographic criteria. The start of the acute assault will determine the day of the operation. Experienced surgeons will perform 30 cases of laparoscopic cholecystectomy. The combined points from the patient's medical history, physical exam, and sonography yield a total score of 15. Randhawa and Pujahari's scoring systems formed the basis of their evaluation and scoring. According to the scale, an easy score is 5, a challenging score is 6–10, and a very difficult score is 11–15.

From the first incision at the port site until the last port was closed, the exact time of the surgery was recorded. Complete documentation of all events occurring during the operation was done. Every patient who underwent LC had their surgical parameters documented in table 2.

Table (2): Difficulty score.

FACTORS	EASY	DIFFICULT	VERY DIFFICULT
TIME TAKEN (MINUTES)	60 min	60-120 min	120 MIN
BILE/STONE SPILLAGE	No	Yes	YES
INJURY TO CYSTIC DUCT OR ARTERY	No	Duct only	BOTH
CONVERSION TO OPEN	NO	NO	YES

Potential risks:

Surgery-related morbidity (1-bile duct injury, 2-hemorrhage,3 3-intra-abdominal collections, 4-wound infection, 5-infected intra-abdominal collections)

Primary outcomes:

Preoperative Randhawa and Pujahari system score for acute cholecystitis, and Intraoperative score of the difficulty of LC.

Sample size

Using Buderer[6], our sample size calculation was based on the sensitivity of the Randhawa and Pujahari system to predict difficult LC in cases of acute cholecystitis. A previous dissertation found that the sensitivity of the system ranged from 77.8% for score 4 to 100% for score 5, with an average of 89%. Assuming a true sensitivity difference of±10% and a prevalence of difficult cholecystectomy of about 20%, we would need to study 30 participants to reject the null hypothesis with 80% power, setting the type I error probability to 0.05.

Statistical analysis:

We used SPSS 25 (Statistical Package for the Social Sciences) to analyse the data. Frequency and percentage were used to express the qualitative data. The mean ± standard deviation (Mean ± SD) was used to express continuous quantitative data. The middle value of a discrete set of integers, calculated by dividing the sum of values by the number of values, is called the mean or average. The dispersion of a group of values can be measured by looking at their standard deviation (SD). The closer the values are to the set mean, the lower the SD, and the more dispersed the values are, the higher the SD. Statistical significance (P-value): A p-value less than 0.05 was deemed significant, a p-value less than 0.001 was deemed very significant, and a p-value more than 0.05 was

deemed insignificant.

The following tests were done:

When comparing two groups using continuous quantitative data, the independent sample T-test (T) is used. Non-parametric categorical data were compared using a chi-square test. Several metrics were measured, including cutoff value, sensitivity, specificity, PPV, NPV, and AUC, using the Receiver Operating Characteristic Curve (ROC). The likelihood that a test will return a positive result in the presence of the condition is known as sensitivity. The specificity of a test is defined as the likelihood that it will provide a negative result in the absence of the disease. When a test comes back positive, the positive predictive value indicates the likelihood that the disease is present. The likelihood that the illness is not present when the test returns a negative result is known as the negative predictive value. The area under the curve (AUC) is a measure of how well a test can distinguish between two groups: AUC (0.5-0.6): the test fails to distinguish between the groups under investigation. The test is fair in discriminating across the groups studied, with an AUC of 0.6-0.7. AUC (0.7-0.8): the test successfully distinguishes between the groups under investigation. The test does a decent job of differentiating across the groups that were tested (AUC: 0.8-0.9). The test does a great job of differentiating across the groups that were studied (AUC: 0.9-1.0).

3. Results

Table 3. Characteristics of the sample population.

		ALL PATIENTS (N=30)	
SEX	Males	11	36.7%
	Females	19	63.3%
AGE	Mean ± SD	48.9±13.3	
	Min-max	29-74	
BMI	Mean ± SD	26.4±1.8	
	Min-max	24-32	
PREVIOUS HOSPITALIZATION	No	22	73.3%
	Yes	8	26.7%

As regard sex, there were 11 males (36.7%) and 19 females (63.3%) in all studied patients. As regard age, the mean was (48.9±13.3) years with range of (29-74) in all studied patients. As regard BMI the mean was (26.4±1.8) with range of (24-32) in all studied patients, (table 3).

Table 4. Description of total score of Ranhawa and Pujahari scoring system in all studied patients.

RANHAWA AND PUJAHARI SCORING SYSTEM		ALL PATIENTS (N=30)
TOTAL SCORE	Mean±SD	4±3.1
	Min-max	0-14

As regard Ranhawa and Pujahari total score the mean was (4±3.1) with range of (0-14) in all studied patients, (table 4; figure 1).

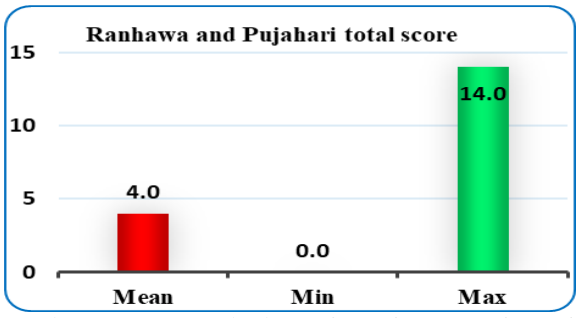


Figure 1. Description of total score of Ranhawa and Pujahari scoring system in all studied patients.

Table 5. Correlation between laparoscope difficulty and Ranhawa and Pujahari scoring system in all studied patients.

RANHAWA AND PUJAHARI SCORING SYSTEM		EASY LAPAROSCOPY (N=19)	DIFFICULT LAPAROSCOPY (N=11)	T	P-VALUE
TOTAL SCORE	Mean±SD	2.4±1.4	6.6±3.4	-4.79	<0.001 HS
	Min-Max	0-7	2-14		

T:independent sample T test; HS:P<0.001 is considered highly significant.

There was high statistically significant (P<0.001) increased Ranhawa and Pujahari score among patients with difficult laparoscopy {mean= (6.6±3.4) with range of (2-14)} when compared with that of patients with easy laparoscopy {mean= (2.4±1.4) with range of (0-7)} in all studied patients, (table 5; figure 2).

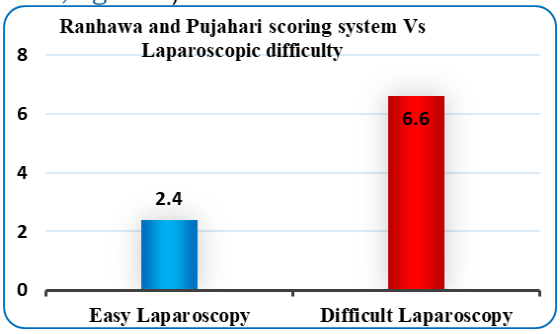


Figure 2. Correlation of laparoscope difficulty and Ranhawa and Pujahari total score in all studied patients.

Table 6. Correlation between laparoscope difficulty and intraoperative difficulty.

		EASY LAPAROSCOPY (N=19)		DIFFICULT LAPAROSCOPY (N=11)		X2	P-VALUE
OPERATIVE TIME	Mean ± SD	58.7±22.9		105.5±34.3		T= -4.49	<0.001 HS
	Min-Max	40-135		60-150			
BILE OR STONE SPILLAGE	No	13	68.4%	1	9.1%	9.9	0.002 S
	Yes	6	31.6%	10	90.9%		
INJURED CYSTIC DUCT OR ARTERY	No	18	94.7%	3	27.3%	15.1	<0.001 HS
	Yes	1	5.3%	8	72.7%		
TYPE OF INJURY	Cystic Duct	1	100.0%	3	37.5%	1.4	0.24 NS
	Cystic Artery	0	0.0%	5	62.5%		
CONVERSION TO OPEN	No	18	94.7%	5	45.5%	9.5	0.002 S
	Yes	1	5.3%	6	54.5%		

T:independent sample T-test; HS:P<0.001 is

considered highly significant;X2:Chi-square test; NS:P>0.05 is considered non-significant; S:P<0.05 is considered significant.

High statistically significant (P<0.001) increased operative time in patients with difficult laparoscopy {mean= (105.5±34.3) minutes with range of (60-150) minutes} when compared with that of patients with easy laparoscopy {mean= (58.7±22.9) minutes with range of (40-135) minutes}.

A statistically significant (P=0.002) increased percentage of patients with bile or stone spillage among patients with difficult laparoscopy (10 patients 90.9%) when compared with that of patients with easy laparoscopy (6 patients 31.6%).

High statistically significant (P<0.001) increased percentage of patients with injured cystic duct or artery among patients with difficult laparoscopy (8 patients 72.7%) when compared with that of patients with easy laparoscopy (1 patients 7.3%) with no significant difference (P=0.24) between them as regard type of injury.

A statistically significant (P=0.002) increased percentage of patients who underwent to conversion to open among patients with difficult laparoscopy (6 patients 54.5%) when compared with that of patients with easy laparoscopy (1 patients 5.3%), (table 6; figure 3).

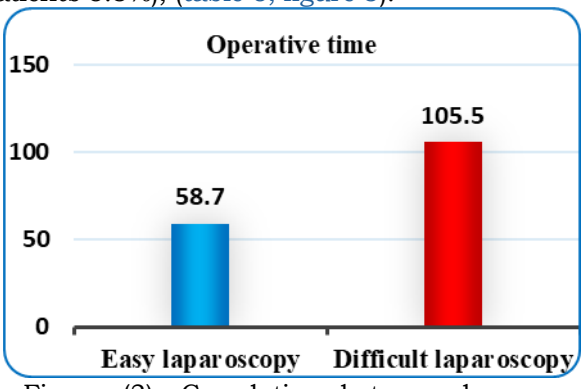


Figure (3): Correlation between laparoscope difficulty and operative time in all studied patients.

Table (7): Diagnostic performance of Ranhawa and Pujahari score in discriminating patients with difficult laparoscope from patients with easy laparoscope in all studied patients.

	CUT OFF	AUC	SENSITIVITY	SPECIFICITY	PPV	NPV	P-VALUE
RANHAWA AND PUJAHARI SCORE	>3	0.902	81.8%	94.7%	90%	90%	<0.001

PPV:positive predictive value; AUC:Area under curve; NPV:negative predictive value.

Using roc curve, it showed that: Ranhawa and Pujahari score was excellent (AUC=0.902) in discriminating patients with difficult laparoscope from patients with easy laparoscope in all studied patients at cut off value of >3 with sensitivity (81.8%), specificity (94.7%), PPV (90%), NPV (90%) and P-value<0.001, (table 7; figure 4).

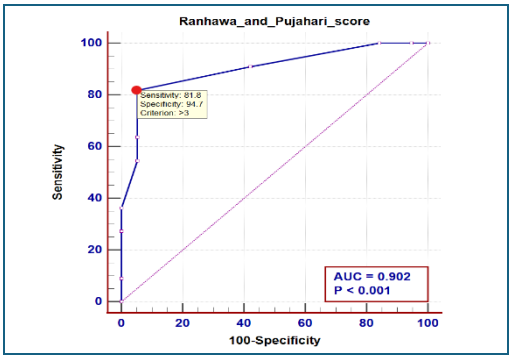
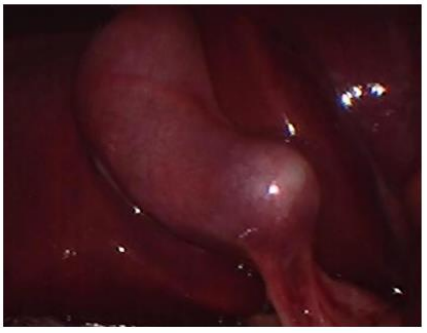


Figure 4. ROC curve of Ranhawa and Pujahari score in discriminating patients with difficult laparoscope from patients with easy laparoscope in all studied patients.

Case presentation:

Case (1):

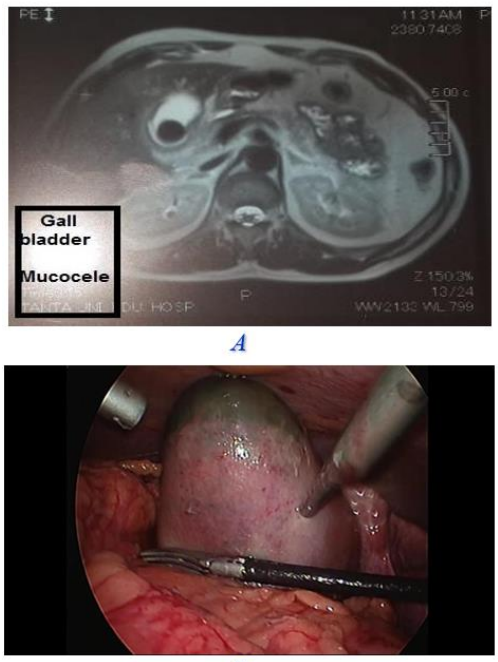


A

B

Figure 5. A&B: Thirty-six years old female patient with pre-operative score 8/15 (difficult) and intra operative score (difficult).

Case (2):



A

B

Figure 6. A&B: Fifty-eight years old female patient with pre-operative score 10/15 (difficult) and intra operative score (very difficult) time 150 minutes and cystic duct injury (mucocele).

4. Discussion

Because surgery is less intrusive, causes less discomfort, and allows for an early recovery, laparoscopic cholecystectomy (LC) has replaced traditional methods as the gold standard for treating gallstone disease symptoms. There are moments when LC is challenging. Even with bile or stone spillage, the procedure takes longer, and in rare cases, an open cholecystectomy conversion is necessary. Predicting the level of difficulty of an operation is extremely challenging.[7]

Women experience acute calculous cholecystitis at a rate three times higher than men up to age 50, and at a rate around 1.5 times higher than men after that age. The research conducted by Fialkowski et al.[8] on Saleem et al.[9] regarding age, the average age of the patients evaluated in this study was 48.9±13.3 years, ranging from 29 to 74 years. All patients included in the study were male (11, or 36.7% of the total) and female (n=19, or 63.3% of the total).

The existence and kind of adhesions creating gall bladder phlegmons are the most important factors determining intraoperative problems, according to intraoperative data.[10] In the study of Ghoneim et al.,[11] all patients had pericholecystic adhesions and gall bladder phlegmons, the most consistent intraoperative finding. Nearly three quarters of the cases had fibrous adhesions, and nearly a quarter had thick adhesions.

Open cholecystectomy was performed in 23.3% of the surgeries in this study. The findings are comparable to those revealed by Ghoneim et al.,[11], 31.5%), Ghanem et al.,[12], 29%). However, it was only 12% in Saleem et al.,[9]

The average preoperative difficulty score for the entire sample was 4±SD 3.1 in our study. With a p-value of 0.001, there was a statistically significant correlation between the intraoperative difficulty assessment and the preoperative difficulty score when comparing the two. An easy status had an average preoperative score of 2.4±1.4, while a difficult status had an average score of 6.6±3.4.

In the study of Mohanaraja[7], this study demonstrated no significant relationship between preoperative grading and surgical outcome, which is consistent with Randhawa & Pujahari[5] new research. This can be because the operating surgeon has extensive experience in surgery. With a sensitivity of 63.64% and a specificity of 94.70%, the scoring system does a good job of predicting challenging surgical outcomes that require conversion. Additionally, 87.50% is the positive predictive value. With an accuracy of 83.33%, this rating system predicts challenging surgical outcomes that require conversion. Predicting a very challenging surgical outcome, such as the need to convert LC to open cholecystectomy, is thus possible with the help of this grading system.

For the purpose of preoperative evaluation using ROC curves, Ranhawa and Pujahari[5] score was excellent (AUC=0.902) in discriminating patients with difficult laparoscope from patients with easy laparoscope in all studied patients at cut off value of >3 with sensitivity (81.8%), specificity (94.7%), PPV (90%), NPV (90%) and P-value <0.001.

Similar results were reported by Kanagala and Nallapaneni[13], Final results showed that preoperative scoring had an 80% overall diagnostic accuracy in predicting difficult LC, with a sensitivity of 94.44%, a specificity of 84.38%, a positive predictive value of 77.27%, a negative predictive value of 96.43%, a likelihood ratio of 6.044 for a positive test, and a likelihood ratio of 0.06584 for a negative test. Therefore, preoperative scoring was highly effective in predicting difficult LC. Thus.

Similar results were reported by Boraii and Abdelaziz[14]; Saleem et al.,[9] had 28 patients (28%) anticipated to have difficult or very difficult cases during preoperative evaluation; 26 patients (26%) had difficult or very difficult cases during surgery; and 2 patients (2% of the total) had easy situations. Surprisingly, nine patients (or 9% of the total) proved to be tough or extremely difficult during surgery, while 72 patients (or 72% of the total) were expected to be easy cases during preoperative evaluation.

The current study found that out of the eleven patients (27%) whose preoperative evaluations were considered to be difficult or very difficult,

seven (21%) had difficult or very difficult surgery; four (6%) cases were found to be easy; and seven patients were converted to open. Eighteen instances (57.5% of the total) were truly easy after surgery, while three cases (5.5%) were tough or extremely difficult, and two were converted to open. Nineteen cases (63% of the total) were projected to be easy during preoperative evaluation. Patients with an easy preoperative score also had an easy intraoperative score, as the x2 value of 57.22 (>18.467) indicates a highly statistically significant (P=0.001) relationship between the two variables in LC patients.

4. Conclusion

Gallstone disease is found to be more common in females than in males; however, it has a statistically significant effect on the surgical outcome of laparoscopic cholecystectomy in acute cholecystitis. BMI is an important indicator for the prediction of surgical outcome. Patients with high BMI are found to have an increased risk of developing gallstone disease, and they also have a high chance of conversion of laparoscopic to open cholecystectomy due to difficult surgical outcomes.

Difficult gallstone disease is found to have an association with patients with a previous history of hospitalization for acute cholecystitis and a history of previous abdominal surgery. A Palpable Gall bladder is also an important indicator for a difficult laparoscopic cholecystectomy, which results in conversion.

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All authors have a substantial contribution to the article

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