ORIGINAL ARTICLE

Prediction of Encountering a Difficult Laparoscopic Cholecystectomy Using Clinical and Sonological Data

Jyotirmaya Nayak[1], Parikshita Dalai[2], Sujit Kumar Mohanty[3], Anil Kumar Behera[4], Ipsita Sahoo[5]

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Abstract

Introduction: Laparoscopic cholecystectomy is the GOLD STANDARD in the treatment of symptomatic cholelithiasis which has replaced the open cholecystectomy as a treatment option since Philip Mouret did the first lap cholecystectomy in the year 1987. Despite its feasibility and acceptability in some cases it becomes quite difficult to proceed laparoscopically and is converted to open cholecystectomy which is associated with increased risk of morbidity. If we can identify the preoperative factors associated with increased risk of conversion then one can optimize operative room efficiency and improve intraoperative planning to avoid surgery-related complications.

Aim of the study: To identify factors that can predict difficult laparoscopic cholecystectomy using clinical and radiological parameters which can be assessed by the Randhwa and Pujahari scoring system.

Materials and methods: This was a prospective observational study conducted from July 2021 to October 2022 at the Department of General Surgery, SCB Medical College, Cuttack. Total of 150 USG-diagnosed symptomatic cholelithiasis patients were included in the study. Total 9 parameters were taken into consideration to assess the preoperative difficulty. These parameters were: (1) Age (2) Sex (3) Previous history of hospitalization for acute cholecystitis (4) BMI (5) Abdominal scar (6) Palpable gall bladder (7) Gall bladder wall thickness (8) Pericholecystic collection (9) Impaction of stone. The statistical analysis was done by Chi-square test.

Results: Out of 150 patients included in this study 90 (60%) were easy, 50 (33.3%) were difficult and 10 (6.66%) were very difficult which required conversion to open. The overall conversion rate was 6.66% which was within the acceptable conversion range, i.e. 1–13%.

Keywords: Calot's triangle, Cholecystectomy, Conversion, Difficult cholecystectomy.

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Introduction

Laparoscopic cholecystectomy is the GOLD STANDARD treatment of Cholelithiasis which is one of the most common ailments affecting the hepatobiliary system. In the United States about twenty million people have gallstones and one million new cases are detected per year. In India, prevalence of gallstone disease is about 4%.[1] In the modern laparoscopic era there is better visualization of the biliary system and the rate of severe biliary injury is less than that of open cholecystectomy. However, in some cases, conversion from laparoscopic to an open technique may be required for various reasons. Thus, for surgeons, it would be helpful to establish criteria that would assess the risk of conversion preoperatively. Multiple factors like age, sex, previous h/o hospitalization for acute cholecystitis, BMI, abdominal scar d/t previous abdominal surgeries, palpable gall bladder, gall bladder wall thickness, and stone impaction, or external factors like equipment failure during surgery influence the level of difficulty.[2–6]

In the literature, there are multiple scales to predict a difficult laparoscopic cholecystectomy but the majority of these emphasize conversion rates or operative times which largely depend upon the expertise of the surgeons.[7,8]

However, out of all laparoscopic cholecystectomies, 1–13% require an open conversion for various reasons; that is why it would be helpful for surgeons to establish a preoperative criterion that would predict the risk of conversion preoperatively.[9] Just by predicting the degree of difficulty, we can choose the surgeons, and attendants of the patient can be counseled better after all the surgical team will be ready for the worst possible situation.[10]

[1–5]Department of Surgery, SCB Medical College & Hospital, Cuttack, Odisha, India

Corresponding Author: Jyotirmaya Nayak, Department of Surgery, SCB Medical College & Hospital, Cuttack, Odisha, India, Phone: +91 9438037714, e-mail: drjmnayak@gmail.com

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Aim of the Study

To identify the factors that can predict difficult laparoscopic cholecystectomy using clinical and radiological data which can be assessed using the Randhwa and Pujahari scoring system.

Materials and Methods

All patients with USG-proven symptomatic gallstone disease were included in this prospective observational trial. All patients with obstructive jaundice, cholangitis, elevated ALP, common bile duct stones, gall bladder empyema, acalculous cholecystitis, or

Table 1: Randhawa and Pujahari scoring method

History		*Max score*	
Age	<50 (0)	>50 (1)	1
Sex	Female (0)	Male (1)	1
H/O Hospitalization	No (0)	Yes (4)	1
Clinical			
BMI	<25	>25–27.5 (1) >27.5 (2)	2
Palpable GB	No (0)	Yes (1)	1
Abdominal scar	No (0)	Infraumbilical (1)	2
		Supraumbilical (2)	
Sonography			
Wall thickness	Thin (0)	Thick >4 mm (2)	2
Impacted stones	No (0)	Yes (1)	1
Pericholecystic collection	No (0)	Yes (1)	1

Table 2: Easy vs difficult criteria for cholecystectomy

Factors	*Easy*	*Difficult*	*Very difficult*
Time taken (Minutes)	<60 min	60–120 minutes	>120 minutes
Bile/Stone spillage	No	Yes	Yes
Injury to duct or artery	No	Duct only	Both
Conversion to open	No	No	Yes

who were deemed unsuitable for surgery were excluded from the research. Between July 2021 and October 2022, the Department of Surgery at SCB Medical College, Cuttack, assessed 150 patients with confirmed gallstones in the United States. Preoperatively, patients' information such as history (age, gender, time since hospitalization due to previous acute cholecystitis attack), clinical examination (BMI, palpable gall bladder, abdominal scar from previous surgery), and USG findings (gall bladder wall thickness, impacted stones, pericholecystic collection) were gathered. Each patient was assigned a preoperative score based on the Randhwa and Pujahari rating method (Table 1).

A score of 5 was considered easy, a score of 6–10 was considered challenging, and a score of 11–15 was considered very difficult. We categorize the patients as likely easy, challenging, or extremely difficult cases before surgery (Table 2). A skilled laparoscopic surgeon used the traditional four-port approach to execute the surgery. The time span was measured from the initial port site incision to the final port's closure. All intraoperative occurrences were documented, and all patients got normal postoperative care.

Statistical Method

The statistical software namely SPSS 22 was used for the analysis of the data and Microsoft Word and Excel were used to generate graphs, and tables etc. The Chi-square test/Fisher exact test has been used to find out the significant association between preoperative score and postoperative outcome.

Results

We included 150 patients in our trial, with 92 (61.33%) being female and 58 (38.6%) being male. The patients' ages ranged from 20 to 70 years. The majority of patients (88.6%) were between the ages of 20 and 50. Out of 150 patients, 57 (38%) had prior episodes of cholecystitis for which they were hospitalized at a neighboring hospital (Table 3). Table 3 shows that out of the 57 patients, 44 (77.19%) underwent a challenging laparoscopic cholecystectomy. Similarly, individuals with a higher BMI (more than 25.5 kg/m^2) had more difficulties during surgery. Out of 150 patients, 60 (40%) had undergone previous abdominal surgeries, with patients with upper abdominal scars experiencing greater difficulty, 30 (76.9%) undergoing difficult laparoscopic cholecystectomy, and 4 (10.2%) undergoing very difficult laparoscopic cholecystectomy. Out of 21 patients with infraumbilical scars, 12 (57%) had a difficult laparoscopic cholecystectomy and 3 (14%) had an open cholecystectomy. Patients with palpable gallbladders had a greater level of difficulty during laparoscopic cholecystectomy, with a 13.2% conversion rate. Patients who had a preoperative USG that revealed a gall bladder wall thickness of more than 4 mm had a greater degree of difficulty. Among the 52 patients, 40 underwent a challenging laparoscopic cholecystectomy, whereas 6 patients, accounting for 11.5%, required an open cholecystectomy. The pericholecystic collection also adds to the rise in the severity of the surgery, as 7 patients, or 15.2%, underwent open conversion. All of the aforementioned criteria show a significant relationship with the difficulty of laparoscopic cholecystectomy, with a p-value < 0.001. However, 29 (55.7%) of 52 patients with impacted stones in preoperative ultrasonography were operated on within 1 hour, 18 (34%), faced challenging procedures, and only 5 had an open conversion.

The connection between stone impaction and difficult laparoscopic cholecystectomy is not significant in this study, with a p-value of 0.5. To recap, it was obvious from Table 4 that out of 88 patients with scores from 0 to 5, 84 received simple surgery and 4 faced intraoperative challenges that could be treated laparoscopically within 120 minutes (Table 4). Similarly, 18 of 24 patients with a score of 6–10 were handled laparoscopically, while the surgeon had to convert 6 patients to open cholecystectomy (Table 4). Out of 150 patients, 40 received scores ranging from 11 to 15, with four undergoing surgeries in under an hour. During surgery, a total of thirty patients faced difficulties, which were successfully managed through laparoscopic treatment for all cases. However, four patients with a score of 11–15 received open cholecystectomy (Table 4).

Discussion

Even though laparoscopic cholecystectomy is the GOLD STANDARD therapy for gallstone disease, predicting the risk of conversion preoperatively is an essential element of laparoscopic cholecystectomy planning. If we can forecast intraoperative issues, more experienced surgeons might be asked to be present during the operation rather than less experienced younger ones who extend the procedure and contribute to intraoperative complications. If the challenges can be predicted prior to surgery, an early conversion decision may be taken to prevent needless surgical extension. A lot of studies have tried to construct grading systems to anticipate intraoperative problems, however, the majority of them are rather difficult to follow. Table 5 shows different rates of conversion for difficult gallstone diseases (Table 5). To anticipate intraoperative problems, we used the Randhawa and Pujahari score method in our research.[11]

The total conversion rate in our research was 6.66%, which was within the allowed range of 1–13%. We assigned a greater score

Table 3: Different outcomes corresponding multiple variables

Variables	*Level*	*Easy (90)*	*Difficult (50)*	*Very difficult (10)*	*Chi-square test*	*p-value*
Age	<50	79	5	4	81.72	<0.001
	>50	11	45	6		
Sex	Female	82	7	3	85.02	<0.001
	Male	8	43	7		
H/O Hospitalization	No	84	6	3	94.9	<0.001
	Yes	6	44	7		
BMI	<25.5	80	4	2	128.2	<0.001
	25.5–27.5	7	42	2		
	≥27.5	3	4	6		
Abdominal scar	No	79	8	3	75.5	<0.001
	Infraumbilical	6	12	3		
	Supraumbilical	5	30	4		
Palp. GB	No	86	8	3	94.6	<0.001
	Yes	4	42	7		
GBW thickness	<4 mm	84	10	4	94.67	<0.001
	≥4 mm	6	40	6		
PCC	No	85	16	3	66.7	<0.001
	Yes	5	34	7		
Stone impaction	No	61	32	5	1.31	0.5
	Yes	29	18	5		

Table 4: Preoperative score vs degree of intraoperative difficulty

Preoperative score	*Easy*	*Difficult*	*Very difficult*	*Total*
0–5	84	4	0	88
6–10	2	16	6	24
11–15	4	30	4	38
Total	90	50	10	

Table 5: Previous studies showing various rates of conversion

Name of study	*Rate of conversion*
Sakpal et al.	3.9–7.2%
Sikora et al.	19%
Peter et al.	14%
Kausik et al.	7.06%
Singh et al.	0.42%
Nanchnani et al.	11.4%

to those above the age of 50, which was shown to be significant ($p = 0.001$). Male sex made surgery more difficult in our research, which was statistically significant. Male sex conversion to open and increased morbidity rate were noted.[12] We assessed two to BMI >27.5 kg/m^2 and had a severe laparoscopic cholecystectomy ($p = 0.001$). A previous history of acute cholecystitis rendered surgery challenging, with a substantial $p = 0.001$ due to pericholecystic adhesions as well as collections with thicker gall bladder walls. Previously, clinically palpable gall bladder had not been described as a predictor of difficult cholecystectomy, but it was shown to be significant with $p = 0.001$ in our investigation. More than 4 mm of gall bladder wall thickness was shown to be related to a higher degree of difficulty and a higher conversion rate. Previous upper abdominal procedures made the laparoscopic cholecystectomy more challenging, maybe owing to increased adhesions. We also discovered that it was statistically significant ($p = 0.001$). The pericholecystic collection which may be a consequence of acute attack also contributed to difficulties ($p < 0.001$). However, sonologically affected stones do not contribute to the degree of difficulty in our investigation. From our investigations, it was determined that the sensitivity and specificity of the scoring method for scores 5–9 are 80.5–91.2% and 80.8–85.8% respectively. From ROC, it was confirmed that this study has high sensitivity as well as high specificity (Fig. 1). The area under the ROC curve was determined to be 0.945 which was statistically significant (Table 6).

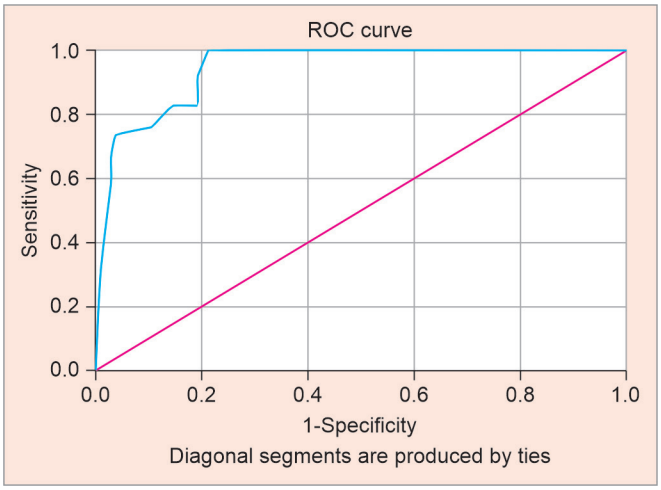

Fig. 1: ROC showing high sensitivity of the study

Table 6: Area under the ROC curve showing significance of the study

Area under the curve				
			95% confidence interval	
Area	*Std. error*	*Significance*	*Lower boundary*	*Upper boundary*
0.945	0.017	<0.001	0.912	0.978

Conclusion

We may infer that the Randhawa and Pujahari score system is a reliable and simple method for identifying the variables responsible for difficult laparoscopic cholecystectomy. However, a limited sample size may be a hindrance to achieving full statistical validity. That is why we suggest a large sample size, and multicentric research to verify and establish the scoring system's effectiveness.

Orcid

Jyotirmaya Nayak https://orcid.org/0000-0003-0452-3522

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