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Original Research Article

Predicting difficulty in laparoscopic cholecystectomy preoperatively using modified Randhawa scoring system

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ABSTRACT

Background: Laparoscopic cholecystectomy is a low-risk, minimally invasive operation and currently the standard for treatment of gallstone and gallbladder disease. Preoperative assessment of difficulty is required to prevent problems, ensure readiness, and ensure an effective course of surgery.
Methods: In our work, we attempted to use a modified grading system developed by Randhawa et al. to preoperatively predict a difficult laparoscopic cholecystectomy. Age, gender, illness duration, history of prior GB disease, BMI, abdominal scar location (infra or supraumbilical), palpable gallbladder, and sonographic findings (gall bladder wall thickness, pericholecystic collection, and impacted stone) were assessed in patients who had been diagnosed with GB stones and required LC. Depending on the individual surgeon's assessment, a procedure is rated as easy, difficult, or very difficult.
Results: On comparison of the test group difficulty level predicted with the gold standard of difficulty level intra op the test group has a sensitivity of 51.9 % and specificity of 100%. The test has a positive predictive value of 100% and Negative predictive value of 91.5%. The test and the gold standard agree on 154 out of 167 having a diagnostic accuracy of 92.21%. The Kappa value of 0.644 indicates very good agreement with a p value of <0.001. Area under the curve indicates 96.1% of the difficulty is predicted by the Total score and significant with p value of <0.001
Conclusions: The current modified Randhawa and Pujahari scoring method is useful and appropriate for forecasting operative outcome in laparoscopic cholecystectomy.

Keywords: Lap cholecystectomy, Prediction, Scoring

INTRODUCTION

Laparoscopic cholecystectomy is a low-risk, minimally invasive operation and currently the standard for treatment of gallstone and gallbladder disease.[1] In 1985, Prof Dr Erich Muhe of Germany performed the first laparoscopic cholecystectomy. At times LC becomes difficult. With the help of accurate prediction, high risk patients may be informed prior to surgery and they may have chances to make arrangements. It helps the surgeon in deciding whether they have to proceed with a minimally invasive procedure or an open procedure or make a referral to a more experienced surgeon. The patients predicted to have a high risk should be scheduled for longer hospitalization and more intensive post-operative care. This also helps the hospital administration to plan and predict admissions and bed vacancy more efficiently. The purpose of this prospective study is to predict a difficult laparoscopic cholecystectomy preoperatively by using Modified Randhawa et al scoring system and to validate the scoring system.

METHODS

After obtaining ethical clearance an observational cohort study was done at Father Muller medical college, where patients undergoing laparoscopic cholecystectomy in department of general surgery were selected from November 2020 to May 2022. 167 patients, who underwent laparoscopic cholecystectomies were studied during the period.

Inclusion criteria

Inclusion criteria for current study are; all patients above 18 years diagnosed to have cholelithiasis and posted for laparoscopic cholecystectomy and willing to be part of the study.

Exclusion criteria

Exclusion criteria for current study are; suspected malignant gall bladder disease and laparoscopic cholecystectomy with common bile duct (CBD) exploration.

Patients diagnosed to have GB stones requiring cholecystectomy were evaluated with following factors age, gender, duration of illness, h/o previous GB disease, concurrent systemic illness, underwent ERCP, BMI (obesity), abdominal scar whether infra umbilical or supraumbilical, upper abdominal tenderness, palpable gallbladder, sonographic findings- gall bladder wall thickness, pericholecystic collection, size and number of calculi, anatomical anomalies (Table 1). The scoring system is adopted from the study done by authors Randhawa et al.[2] The authors classified LC as easy, tough, and very difficult with scores of 0-5, 6-10, 11-15, respectively, based on the final scores after summing the scores of each parameter. Individual parameters are given appropriate scores, which were obtained based on statistical analysis (Table 2).

The authors compared these predictions to intraoperative results to see if the procedure that was expected to be easy, tough, or very difficult actually was the same. The time required for the surgery, any damage to the cystic artery, cystic duct, or CBD, any leakage of bile or gallstones, and conversion of the surgery to an open procedure were the parameters that the authors used to evaluate the surgery as easy, difficult, or very difficult (Table 2). As in the studies conducted by Almuhim et al, Rhezhii et al, and Randhawa et al authors in the current study modified the Randhawa JS et al. score (Table 1) by removing gender as a factor in predicting difficulty. In the current study, there is no statistical significance in gender associated with gender. There are difficulties doing a laparoscopic cholecystic-tomy on a patient after an ERCP, according to investigations by Reinder et al and Mann.[3,4]

Table 1: Present modified Randhawa et al scoring system.

History	Finding (score)	Maximum score
Age	<60 (0), >60 (1)	1
H/o previous attacks of cholecystitis	No (0), yes (2)	2
Post ERCP/ stenting	No (0), yes (2)	2
BMI	<25(0), 25-27.5 (1), >27.5(2)	2
Abdominal scar	No (0), infraumbilical (1), supraumbilical (2)	2
Palpable gall bladder	No (0), yes (2)	2
Wall thickness	<4 mm (0), >4 mm (2)	2
Pericholecystic collection	No (0), yes (1)	1

Table 2: Easy/difficult present study criteria.

Surgeon's opinion	Criteria
Easy	Time taken <60 mins, No bile spillage, No injury to duct or artery
Difficult	Time taken 60-120 mins, Bile/stone spillage, Injury to duct, No conversion
Very difficult	Time taken >120 mins, conversion to open

Statistical analysis

For categorical or binary data, proportions were used in the summary statistics, and for continuous variables, mean, median, and standard deviation. The chi square test, independent t test, multivariate logistic regression by enter technique, and Area under curve with ROC curve were used for inferential statistics. SPSS 21.0 for Windows was used for all of the statistical calculations. Statistics were judged significant at $p<0.05$. Two or more independent proportions are compared using the chi square test or the Fisher exact test. When there are fewer than five predicted numbers in cells with >25% of them, Fisher exact is employed. To compare means between independently selected groups or mutually exclusive groups, an independent t test was performed.

RESULTS

Gall stone disease was found to be most common in patients below 50 years of age in our study. Oldest patient was 80 years, youngest was 23 years. Even though as the age advances the difficulty in surgery increases but not statistically significant in our study. Gall stone disease was

found to be more common in females than males. No. of females 95 (56%), number of males 72 (44%) (Table 3).

Table 3: Gender distribution.

Sex	N	Parameter coding (1)
Female	95	0.000
Male	72	1.000

Thirty-two patients had undergone ERCP prior to the operation, and a total of thirty patients had h/o cholecystitis (Table 4). It is challenging to skeletonize the cystic duct and cystic artery in these patients due to intraoperative adhesions that are frequently discovered. Both in univariate and multivariate analyses, it was discovered that analysis without hospitalisation and ERCP was substantially significant in predicting problematic LC. Total 155 patients had BMI <27.5 and 12 patients had BMI >27.5. Authors found difficulty in operating high BMI patient. 9 patients had infra umbilical scar. Most of the infra umbilical scars are tubectomy scar.

Presence of abdominal scar not found to be significant in predicting difficult LC (p value=0.6) (Table 5). Wall thickness <4 mm seen in 153 cases and >4 mm seen in 14 cases. Patients with h/o cholecystitis had thickened wall, with difficult laparoscopic cholecystectomy (p<0.001). 14 patients had WBC >10000 and 7 patients were found to have difficult laparoscopic cholecystectomy (p<0.001) (Table 6).

Table 4: Status post ERCP.

Parameters	Categories	Total number	Difficulty level INTRA-OP		Chi square	P value
			Easy N (%)	Difficult N (%)		
Post ERCP	No	135	124 (88.6)	11 (40.7)	33.43	<0.001
	Yes	32	16 (11.4)	16 (59.3)		

Table 5: Body mass index (BMI) and intra-abdominal scar.

Parameters	Categories	N	Difficulty level intra-op		Chi square	P value
			Easy N (%)	Difficult N (%)		
BMI (25-27.5 or >27.5)	25-27.5	155	128 (91.4)	27 (100)	2.493	0.114
	>27.5	12	12 (8.6)	0 (0)		
Intra-abdominal scar	No scar	158	133 (95)	25 (92.6)	0.257	0.612
	Intra-abdominal scar	9	7 (5)	2 (7.4)		

Table 6: White blood cell count and gall bladder wall thickness.

Parameters	Categories	N	Difficulty level intra-op		Chi square	P value
			Easy N (%)	Difficult N (%)		
WBC >10000	<10000	153	133 (95)	20 (74.1)	12.905	<0.001
	>10000	14	7 (5)	7 (25.9)		
Wall thickness cutoff 4 mm	<4 mm	153	140 (100)	13 (48.1)	79.235	<0.001
	>4 mm	14	0 (0)	14 (51.9)		

Table 7: Pericholecystic collection and impacted stone.

Parameters	Categories	N	Difficulty level intra-op		Chi square	P value
			Easy N (%)	Difficult N (%)		
Pericholecystic collection	No	156	140 (100)	16 (59.3)	61.059	<0.001
	Yes	11	0 (0)	11 (40.7)		
Impacted stone	No	147	131 (93.6)	16 (59.3)	25.279	<0.001
	Yes	20	9 (6.4)	11 (40.7)		

Pericholecystic collection seen in eleven cases and impacted stone seen in twenty cases. Presence of pericholecystic fluid (p<0.001) and impaction of stone (p<0.001) was found to be strongly significant in preoperative assessment (Table 7). Of the 167 patients 153 scored preop easy, of which 140 were found easy intra op and 13 were difficult. 12 scored preop difficult, of which 12were difficult intra-op. 2 scored preop very difficult, 2 were very difficult. On comparison of the test group difficulty level predicted with the gold standard of difficulty level intra op the test group has a sensitivity of 51.9% and specificity of 100%. The test has a positive predictive value of 100% and Negative predictive value of 91.5%. The test and the gold standard agree on 154 out of 167 having a diagnostic accuracy of 92.21%. The Kappa value of 0.644 indicates very good agreement with a p

value of <0.001. Area under the curve indicates 96.1% of the difficulty is predicted by the total score and significant with p value of <0.001.

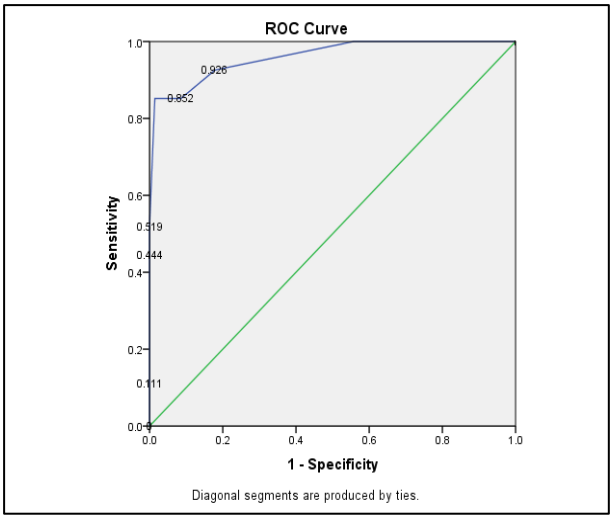

Figure 1: ROC curve and its area under curve for predicting the operative outcome based on preoperative scores.

DISCUSSION

In an animal model, Fillipi et al performed the first laparoscopic cholecystectomy in 1985.[5] The gall bladder was successfully removed by Philip Mouret in 1987 using an unmagnified mechanical rigid pipe instead of a laparotomy. The complication rate for LC was initially considerable, but as technology and knowledge have advanced, it has now dropped to an astonishingly low level of 2.0-6.0%.[6] A 7-35% conversion rate has been documented in the literature.[7] This study is prospective and observational. The current study's objectives are to predict a difficult laparoscopic cholecystectomy using a scoring system developed by Randhawa et al and to assess each of the scoring system's unique epidemiological, clinical, and radiological characteristics.[2] As in research by Al-Mulhim et al, Rhezhii et al and Randhawa et al authors in the present study changed the Randhawa JS et al. score by eliminating gender as a factor in predicting difficulty, even though the present study indicates no correlation in predicting difficulty.[8] Based on the examination of the study's findings, we came to the conclusions that are stated in this article. In their investigations, Nidoni et al and Rhezhii et al discovered that cholelithiasis was most prevalent in the age range between 30 and 50 years. In my study, a similar age distribution pattern was discovered in patients with cholelithiasis, with 30 to 50 years being the most common age group.[9,10] According to studies, male sex makes surgery challenging.[11,12] Male sex has been shown to have a much higher mortality rate and conversion rate. It wasn't discovered to be a significant in our study. According to Rosen et al obesity has been identified as a risk factor for challenging laparoscopic cholecystectomy.[13] However, some studies assert that there was no difference between obese subjects' operating times, times to begin general diets, hospital stays, or complications.[14] In our investigation, BMI >25 had no significant impact on the outcome and the proportion of simple and complex cases was nearly identical in both patient groups (BMI 25-27.5 and >27.5). In their study, Vivek et al and Rhezhii et al discovered that having a history of prior hospitalizations due to acute cholecystitis attacks made LC challenging and thus increased the likelihood of conversion.[10,15] With a p value of 0.001, the history of past attacks was determined to be highly significant in the current investigation. Adhesions between the viscera or omentum and the abdominal wall may exist following prior upper or lower abdominal surgery. These structures may be damaged while the initial port is being inserted, and conversion risk has been noted to be higher.[11] Only 9 patients in our study had infra-umbilical scars; none had supra-umbilical scars. It was not found to be a significant confounding factor (p value 0.612). In previous research, the thickened gall bladder wall, an ultrasonographic finding indicating acute cholecystitis, was a significant factor. Majeski James demonstrated in 1990 that a preoperative gallbladder ultrasound examination for symptomatic cholecystitis that reveals a thick gallbladder wall (=3 mm) with calculi is a clinical warning for the laparoscopic surgeon of the potential for a challenging laparoscopic cholecystectomy procedure that may require conversion to an open cholecystectomy procedure.[16] However, Carmody et al came to the conclusion that a thorough preoperative ultrasound examination of the gallbladder in patients scheduled for laparoscopic cholecystectomy is not very useful in identifying challenging or unsuitable situations. They came to the conclusion that there were no ultrasonography features that could distinguish between unsuccessful, challenging, or successful laparoscopic cholecystectomy.[17] In this study thickened gall bladder was found in 14 patients and suggested difficult laparoscopic cholecystectomy which was statistically significant (p<0.001). Gupta et al and Randhawa et al in their study found palpable GB as statistically significant parameter in predicting difficult laparoscopic cholecystectomy.[10] No patients in our study had palpable gall bladder, hence this criterion could not be evaluated. An ultrasonographic sign of acute cholecystitis is pericholecystic fluid. In our study 11 patients had the same and this was statistically significant (p<0.001). Our results do not support the observations made by Randhawa et al.[2] The grading method examined in this study serves as a solid, trustworthy, and helpful standard to identify complex cases. However, the small sample size may be an impediment in attaining complete statistical validity. We propose large scale, multicentric studies to validate the scoring methodology and establish its efficacy.

CONCLUSION

It can be inferred that the grading system included in our study provides a solid, trustworthy, and practical standard to identify challenging scenarios in laparoscopic

cholecystectomy. This scoring system has the advantage of taking into account tests that are often done, requiring no specialised equipment, and being simple to comprehend and implement. This scoring system is suitable for educational institutions. With proper backup from senior surgeons, anaesthetists, operating room staff, and the right operating room equipment, this scoring system makes greater preparation possible. Based on their results from this scoring system, patients can receive better pre-operative counselling regarding potential outcomes.

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