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Original Research Article

Use of scoring system to predict difficult laparoscopic cholecystectomy

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ABSTRACT

Introduction: Laparoscopic cholecystectomy is the gold standard for treatment of symptomatic cholelithiasis. Most of the time it is easy and safe. However, difficulties may occur at times leading to difficult dissection, prolong operative time, injury to artery, injury to duct, bile spillage and injuries to surrounding viscera and conversion to open. This study aims to predict difficult laparoscopic cholecystectomy using preoperative scoring system.
Methods: This was a prospective observational analytical study conducted at Department of Surgery, Bir Hospital over a period of one year. One hundred thirteen patients undergoing elective laparoscopic cholecystectomy for symptomatic cholelithiasis were included. Before the surgery patients were scored according the preoperative model, and the intraoperative scoring was recorded during the surgery. Finally, the two scoring systems were compared.
Results: Sensitivity and specificity of preoperative scoring according to Randhawa scoring was 57.6% and 87.5 % respectively with PPV and NPV of 65.5% and 83.3% respectively. Factors like history of acute cholecystitis ($p<0.05$), pericholecystic collection ($p=0.025$) were found to be statistically significant in predicting DLC. Area under ROC curve was 0.725.
Conclusion: Preoperative scoring is a good test to predict difficult laparoscopic cholecystectomy which is statistically significant with Area Under ROC curve 0.725. Preoperative scoring has potential advantage in surgical planning and counselling for possible complications.

Keywords: Gall stone, Laparoscopic Cholecystectomy, Cholecystitis, Preoperative score

INTRODUCTION

Cholelithiasis is one of the common causes of abdominal pain and is a major cause of morbidity and mortality.[1] The literature about prevalence of gall stone disease in Nepal was sparse, but one study conducted by Pahari et al at Kathmandu Medical College and Teaching Hospital reported it to be around 15.76%.[2] LC (laparoscopic cholecystectomy) is considered as the gold standard surgical procedure for the management of patients with symptomatic gallstones. At times LC becomes difficult. Difficult cases result in prolonged operative time, bleeding, bile spillage, bile duct injury and need for conversion to open. LC conversion to open cholecystectomy is sometimes inevitable. It is very difficult to say preoperatively whether procedure is going to be easy or difficult in particular patient. Difficult laparoscopic cholecystectomy and conversion to open surgery can be predicted preoperatively based on number of previous attacks of cholecystitis, WBC count, gall bladder wall thickness and presence or absence of pericholecystic collection.[3] Patient factors, presentation, preoperative ultrasonography findings and surgeon's experience, all contribute to the possibility of conversion of laparoscopic cholecystectomy to open surgery4. While conversion to open cholecystectomy will always be an

essential part of safe surgical practice, a greater understanding of the factors leading to conversion and potential postoperative complications seems essential. Randhawa et al proposed the scoring system for prediction of difficulty for LC. In his study this scoring was statistically and clinically a good test for predicting the operative outcome in LC (area under ROC=0.82). Therefore, this study is aimed to determine the predictive factors for a difficult laparoscopic cholecystectomy and to validate: the preoperative scoring proposed by Rhandhawa et al.[5] To compare the outcomes from Rhandhawa scoring intraoperatively, in this study we used Intraoperative grading system proposed by Sugrue et al6. This article has been in line with revised STROCSS guideline, 2025".[7]

Objective of this study is to provide surgeons with an evidence-based tool to better prepare for the procedure. By identifying patients at high risk for a difficult surgery the scoring system can help surgeons make informed decisions such as allocating more time, having additional surgical instruments or staff on standby, or considering an early conversion to open cholecystectomy.

METHODS

This is prospective cross-sectional observational study done in the department of General Surgery, National Academy of medical sciences Bir Hospital, Mahabouddha, Kathmandu, Nepal after obtaining ethical approval from the institutional review board (IRB) of NAMS from December 2023 to October 2024. This study included 113 patients (22% male, 78% female) undergoing elective laparoscopic cholecystectomy for gall stone disease.

Inclusion criteria

All patient who is planned for elective LC in Bir Hospital

Exclusion criteria

Patients with CBD calculus, dilated CBD, where CBD exploration is needed and patient undergoing emergency laparoscopic cholecystectomy.

Prior to scheduled surgery, complete history and physical examination was done along with ultrasonography of abdomen. Patient was given preoperative score (Table 1).[5] Laproscopic cholecystectomy was done with standard 4 port technique by experienced surgeons and intraoperative scoring was given by operating surgeon.[8] On postoperative day 1, preoperative score and intraoperative events were compared and conclusions were noted in the proforma.

Statistical analysis

The data was collected manually using the printed porforma in bedside and stored in the electronic database (MS Excel 2016) and was statistically analysed by transferring it to the statistical software, statistical Package for Social Sciences, SPSS version 25.0 for windows. Chi-square test was applied for comparing the association variables. Fisher's exact test was used where sample size was less than five in any category. Area under receiver operator characteristics (ROC) curve was used to predict diagnostic accuracy of scoring system. Mean and range was used to show distribution of data. P value <0.05 was considered statistically significant. Oneway ANOVA test was used to compare means.

RESULTS

Among 113 cases 74% were easy and 23.9% were moderately difficult and only 1.8% case were difficult as predicted by preoperative score (Table 3). The mean age of the study population was 45 years with minimum and maximum age being 16 years and 78 years respectively. In the study, age had no significant impact on prediction of difficulty. Among 113 patient 37 patient had BMI less than 25 whereas 36 patients had BMI between 25 and 27.5. 40 patients had BMI >27.5.

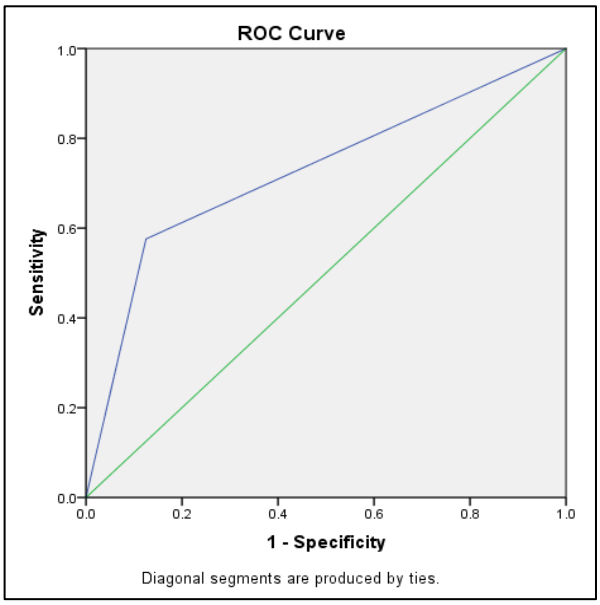

Figure 1: ROC curve determination from the study.

Increased BMI was not associated significantly with difficulty intraoperatively in the study. 40 patient (35.4%) had history of previous hospitalization for right upper quadrant pain or previous h/o acute cholecystitis. Out of 40 patient 20 patient had moderately difficult LC and one patient had very difficult LC. Among all parameters h/o acute cholecystitis in past and pericholecystic collection seen during pre-operative ultrasound had significant impact during intraoperative period with p value of <0.001 and 0.025 respectively (Table 5). As per intraoperative scoring 75.2 % cases were easy, 23.9% cases were moderate and 0.9 % cases were difficult. None of the cases fall into extremely difficult case (Table 4).

Table 1: The preoperative scoring system.[5]

Characteristics			
Age in years	<50 (0)	>50 (1)	1
Sex	Female (0)	Male (1)	1
History of previous hospitalization	N (0)	Y (4)	4
Clinical findings			
Body mass index (BMI)	<25 (0)	25-27.5 (1)	2
>27.5 (2)			
Abdominal scar	N (0)	Y (1)	1
Palpable gallbladder	N (0)	Y (1)	1
Abdominal ultrasound			
Wall thickness	Thin (0)	Thick>4 mm (2)	2
Pericholecystic edema	N (0)	Y (1)	1
Impacted stone	N (0)	Y (1)	1

Score: <5: easy, 6–10: difficult and 11–14: very difficult

Table 2: Intraoperative scoring system.[8]

S. no.	Operative findings	Tick if present
1.	Appearance of gallbladder (either one of three)	
	No adhesions of GB (0 point)	0
	Adhesions <50 % of GB (1 point)	1
	Adhesions >50% but GB buried (2 points)	2
	Completely buried GB (3points)	3
2.	Distended GB or contracted shrilled GB (1 point)	1
3.	Inability to grasp without decompression 1 (1 point)	1
4.	Stone > 1 cm impacted in Hartmann's pouch (1 point)	1
5.	BMI > 30 (1 point)	1
6.	Adhesions from previous surgery limiting surgery (1 point)	1
7.	Free bile or pus outside the gallbladder (1 point)	1
8.	Fistula (1 point)	1

Grading of degree of difficulty Easy (<2), Moderate (2-4), Difficult (5-10).

Table 3: Pre-operative categorization of cases.

Preoperative prediction	Frequency	Percentage
Easy	84	74.3
Moderate	27	23.9
Difficult	2	1.8
Total	113	100

Table 4: Intra-operative categorization of cases.

Intraoperative findings	Frequency	Percentage
Easy	85	75.2
Moderate	27	23.9
Difficult	1	0.9
Total	113	

Table 5: Correlation of individual pre-operative variables with intraoperative score.

Parameters		Easy (in %)	Difficult (in%)	P value
Age (in year)	<50	56 (76.7)	17 (23.3)	0.62*
	>50	24 (60.0)	16 (40.0)	
Sex	Female	65 (73.9)	23 (26.1)	0.179*
	Male	15 (60.0)	10 (40.0)	

Continued.

Parameters		Easy (in %)	Difficult (in%)	P value
H/O acute cholecystitis	No	61 (83.6)	12 (16.4)	<0.001*
	Yes	19 (45.5)	21 (52.5)	
BMI	<25	32 (80.0)	8 (20.0)	0.278*
	25 to 27.5	22 (66.7)	11 (33.3)	
	>27.5	26 (65.0)	14 (35.0)	
Palpable GB	No	79 (70.5)	33 (29.5)	0.1**
	Yes	1 (100)	0 (0.00)	
Abdominal scar	No	73 (73.0)	27 (27.0)	0.169*
	Yes	7 (58.03)	6 (41.7)	
Gb wall thickness	No	79 (70.5)	33 (29.5)	1.000**
	Yes	1 (100)	0 (0)	
Pericholecystic collection	No	79 (73.1)	29 (26.9)	0.025**
	Yes	1 (20.0)	4 (80.0)	
Impacted stone	No	77 (72.0)	30 (28.0)	0.355**
	Yes	3 (50.0)	3 (50.0)	

Chi-square test (*); Fisher's exact test (**)

DISCUSSION

LC is one of the most frequently performed major surgeries in our hospital. However, it occasionally becomes necessary to convert LC into open Cholecystectomy. Preoperative prediction of DLC has potential advantage for surgeon, patients and their relatives. Surgeon may plan operation list for the day accordingly based on predicted difficult cases by scheduling difficult cases early morning during which all the senior faculties are available.

This also helps in assigning more experienced surgeon for performing the case predicted to have DLC and selecting appropriate cases for trainee. This scoring also helps to make quick decision regarding conversion to open when difficulties are encountered. This study was conducted to determine predictive factors of a difficult cholecystectomy and validate the scoring system developed by Randhava et al and intraoperative grading system developed by Sugrue et al.[5,8] Several studies have been published in the past years trying to assess risk factors for DLC. Various studies have shown that increasing age is associated with DLC. In a study done by Awan et al the mean age of patients was 45.6 years.[9] In the study the mean age of patient was 45 years which is similar to study by Awan et al with age range 17 years to 78 years.[9] Maximum patient lie in age group of 31 to 50 years (47.7%). Authors had given higher score for age >50 years. There were 40 (35.4%) patient age more than 50 in study, among them 16 (48.5%) patients had moderate to severe difficult LC with p value of 0.62.

In the study, age >50 has been found to be statistically insignificant as a factor for difficult LC which is probably due to surgical experience in LC. In the study there was only one case of conversion of LC to open cholecystectomy, patient was 67 years old. Bat et al, Yetkin et al and Brodsky et al showed higher conversion rate and difficulty in elderly.[10,12] However, in study done by Randhawa et al and Joshi et al increasing age was statistically non-significant probably due to experienced surgeons performing operation.[5,13] In the study only 23.33% were male out of which 65.71% had DLC. Only one case got converted to open in my study that it was in male gender. Ambe et al published a paper on May 2015 which was designed to investigate the gender dependent risk of complication in patients undergoing laparoscopic cholecystectomy. In that paper male gender was identified as an independent risk factor for prolonged laparoscopic cholecystectomy on multivariate analysis.[14] He also concluded that the male group was significantly older (p=0.001).

In the study 40 (35.5%) patients were above 50 years and among them 15 (60%) were male. It shows that although female undergo LC more often than male but male presents at older age than female and had difficult LC than female. Various studies have shown that prior history of acute cholecystitis has strong prediction of DLC. In the study, 34.5% of the cases had past history of acute cholecystitis. Among those who had history of acute cholecystitis 63.6% cases had DLC. Therefore, acute cholecystitis was found to have strong prediction of DLC which was statistically significant (p value<0.001). This was similar to study done by Brodsky et al, Randhawa et al and Joshi et al.[12,13]

In the center we do not perform LC in asymptomatic cholelithiasis which may have contributed to greater proportion of patient with prior history of cholecystitis. In all patients with history of acute cholecystitis, delayed LC was done, at least 6 weeks later. Authors do not routinely perform early LC for acute cholecystitis in our hospital. Difficulty associated with prior history of acute cholecystitis was secondary to adhesion of gallbladder to surrounding structures as a result of inflammatory process and frozen calot's triangle structure. Multiple studies showed that abdominal scars are one of the causes for difficult LC. In the study done by Vivek et al upper

abdominal surgeries were found to be statistically significant.[15] In the study 13 patient had scar from previous abdominal operation and among them 6 patient had difficult LC. However, it is not statically significant in our study that might be due to small number of cases in this category. Clinically palpable GB was present in only 1 case. Palpable GB was statistically non-significant probably due to small number of patients presenting with palpable gallbladder. Thickened GB wall (>4 mm) was present in 1 case. In this study due to small number of patients we cannot comment on its contribution for DLC. Intraoperatively none of the patient had bile duct injury and injury to artery.

Total 20 (17%) patient faced complications. Out of which 12 had bile leak while handling GB and 8 patients required drain placement. In all the cases bile spillage was either from GB fossa or ruptured GB wall during dissection. In those cases, who had bile spillage suctioning was done along with wash using normal saline, irrigation and retrieval of stone. GB was removed using a retrieval bag in case of bile spillage. One patient who was predicted difficult preoperatively had difficulty intraoperatively and underwent conversion to open cholecystectomy.

As authors have included only those cases done by experienced surgeon in our study, this may have contributed to decreased incidence of injury to artery and duct. Only those patients who were fit for elective operation were included in the study.

Though 30 patients were found to be difficult during intraoperative period only one of them was converted to open. By this we can conclude that even though cases are difficult it can be tackled laparoscopically. But time taken for difficult cases were much more than easier one. None of the easy case took more than 90 min but moderate and difficult cases required 2 to 3 hours to complete the case. In many studies operative time more than 60 min has been kept as one of the factors determining difficulty of LC16, time more than 120 min is predictor of very difficult case. In a study done by Shrestha et al. operating time was 25-120 minutes with a mean of 71.9 minutes.[17] In this study mean operating time was 60 min which is similar to result of Shrestha et al. Preoperative scoring is a good test for predicting DLC as shown by ROC curve with AUC 0.725 according to Randhawa et al scoring of the study.

CONCLUSION

Preoperative scoring is a good test to predict DLC which is statistically significant (AUC 0.725) p value <0.001). Routine use of preoperative prediction has potential advantage to surgeon, patient and patient's family members. This helps in improving proper planning of operation list, scheduling the cases, allocating the predicted difficult cases for more experienced surgeon, selecting appropriate cases for trainee in teaching hospitals, taking consent, making quick decision regarding conversion to open when difficulties are encountered and preparation of patient and family members for anticipated complications both emotionally and financially.

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