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Evaluation the efficacy of scoring method for pre-operative prediction of difficult laparoscopic cholecystectomy

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Abstract
Laparoscopic Cholecystectomy the procedure of choice for symptomatic Cholelithiasis. Preoperative prediction of a difficult cholecystectomy and the risk of conversion is of great help both to the patient who can plan his work and the surgeon who can also schedule his time and team accordingly. Randhawa developed a scoring method on the basis of History, Clinical Examination and Sonological findings to predict difficult Laparoscopic Cholecystectomy preoperatively. We are conducting this study to evaluate the efficacy of Randhawa scoring method in pre-operative prediction of difficult laparoscopic cholecystectomy and to identify the predictors of difficult laparoscopic cholecystectomy which will help the surgeon to provide better surgical care to the patient.

Keywords: Difficult laparoscopic cholecystectomy, randhawa scoring method

Introduction

Laparoscopic cholecystectomy since its inception in 1987, has dramatically replaced conventional open cholecystectomy. Laparoscopic Cholecystectomy has rapidly become the gold standard for routine cholecystectomy. Management of cholelithiasis has evolved from being a major procedure to a relatively safe and tolerable day care procedure today, offering early return to full activity [1]. However, there are numerous conditions which make the operation difficult necessitating conversion to open surgery. Several studies have delineated various factors in prediction of difficult laparoscopic cholecystectomy are elderly patients , males, recurrent cholecystitis, obese patients, previous surgery, patients who needed preoperative Endoscopic retrograde cholangiopancreatography (ERCP), abnormal serum hepatic and pancreatic enzyme profiles, distended or contracted gall bladder, intra-peritoneal adhesions, structural anomalies or distortions and the presence of a cirrhotic liver on ultrasonography (USG) were identified as predictors for difficult laparoscopic cholecystectomy [2].

These factors are markers of difficult laparoscopic cholecystectomy and these patients often end up requiring open cholecystectomy. With increasing experience in laparoscopic surgery and advancement of technology, many of the difficulties due to anatomical and patient factors can be dealt with laparoscopically [3].

Preoperative prediction of a difficult cholecystectomy and the risk of conversion is of great help both to the patient who can plan his work and the surgeon who can also schedule his time and team accordingly. Some factors should be designed which would definitely help surgeons in making unbiased standard predictions. We would definitely be able to clearly state and define "difficult cholecystectomy", prior to taking the patient to the operation theatre, and this would help the surgeon to provide better surgical care to the patient

Randhawa *et al*. made a scoring system including various predictors to predict difficult laparoscopic cholecystectomy. Predictors include Age, Sex, BMI >27.5 kg/m2, palpable gallbladder, previous upper abdominal Surgery, post ERCP, abnormal LFT, S. Amylase/S. Lipase, sonology finding. A score of 0-15 scales the level of difficulty of laparoscopic cholecystectomy [4].

This study is to evaluate the Scoring method by Randhawa *et al.* for Preoperative prediction of Difficult laparoscopic cholecystectomy.

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Aim and Objectives
Aim
- To evaluate the efficacy of scoring method for pre-operative prediction of difficult laparoscopic cholecystectomy.

Objective
- To identify the predictors of difficult laparoscopic cholecystectomy.

Material and Method
Study Area: The study was conducted in the General surgery department of S.M.S Medical college & Attached Group of Hospitals, Jaipur.

Study Design: The present study was a hospital based analytic type of observational study.

Study Period: The study period was from June 2018 to December 2019.

Sample Size: Sample size was calculated at 95% confidential level assuming proportion of difficult laparoscopic cholecystectomy 37%. Among all laparoscopic cholecystectomy at 10% absolute allowable error, sample size was found 90 patients undergoing laparoscopic cholecystectomy which was further enhanced and rounded off to 100 such patients

Sampling Technique: Every case falling in inclusive criteria till the sample size completed.

Sample Population: All the cases of elective Laparoscopic Cholecystectomy, which meet the inclusion and exclusion criteria, done in a single surgical unit operated by a single surgeon in SMS Medical College, Jaipur, in the given period.

Inclusion Criteria
- All patients 16 to 70 years of age presented with cholelithiasis, confirmed by ultrasonography.
- Patients giving consent for laparoscopic cholecystectomy.

Exclusion Criteria
- Laparoscopic cholecystectomy performed with other laparoscopic intervention in same setting.
- Laparoscopic cholecystectomy with common bile duct exploration.
- Patients unfit for Laparoscopic cholecystectomy.

Methodology
- All the cases of elective Laparoscopic Cholecystectomy done in a single surgical unit operated by a single surgeon in SMS Medical College, Jaipur were included for the study from June 2018 to December 2019.
- The cases of Laparoscopic cholecystectomy conversion to open cholecystectomy due to equipment failure and any emergency surgeries were excluded from the study.
- After the OPD workup, the scoring was done one-day prior to surgery on admission as per Randhawa *et al.* scoring method Table 1. Score up to 5 was defined as easy, 6–10 as difficult and 11–15 as very difficult.
- A written consent explaining the probable complications and possibility of conversion to open surgery was also obtained

Scoring Method for Prediction of Difficult Laproscopic Cholecystectomy
FACTORS
History - Age/ Sex/ H/o Hospitalization
Clinical - BMI/ Abdominal scar/Palpable Gallbladder
Sonography - Wall thickness/ Pericholecystic collection/ Impacted stone
Total maximum score-15 Minimum score-0
Score-
- 0 to 5 - Easy
- 6 to 10 - Difficult
- 11 to 15 - Very Difficult

Table 1: Preop Scoring - Predictive Factors Max

History			
Age	<50yrs (0)	>50yrs (1)	1
Sex	Female (0)	Male (1)	1
H/o Hospitalization	No (0)	Yes (4)	4
Clinical			
BMI Wt(kg)/Ht (m²)	<25(0)	25-27.5(1) >27.5(2)	2
Abdominal scar	No (0)	Infraumbilical (1) Supraumbilical (2)	2
Palpable Gallbladder	No (0)	Yes (1)	1
Sonography (Abdomen)			
Wall thickness	Thin (0)	Thick>4mm (2)	2
Pericholecystic collection	No (0)	Yes (1)	1
Impacted stone	No (0)	Yes (1)	1

Laparoscopic Cholecystectomy
Under general anaesthesia, Surgery was done using CO_2 pneumoperitoneum with 13 mm Hg pressure. Standard four port cholecystectomy was done in all cases. two 5 mm ports and two 10 mm ports were used. The timing was noted from the first port site incision till the last port closure. All the intra-operative events were recorded. The entire cases received standard postoperative care and follow up.

Operative notes and data record
- The operative time was noted from the 1st incision to last skin sutures application.
- Difficulty of cholecystectomy was graded as per Randhawa *et al.* criteria as given in Table 2

Table 2: Operative Difficulty Criteria

Easy	Time taken <60min No bile spillage No injury to duct/artery
Difficult	Time taken 60-120mins Bile/stone spillage Injury to duct No conversion
Very difficult	Time taken >120 mins Conversion

- Conversion rates and reasons for conversion were noted.

Data collection and analysis
- The proforma for each patient were filled meticulously and systematically.
- All the data were compiled on Microsoft excel computer program and were calculated to evaluate the scoring method
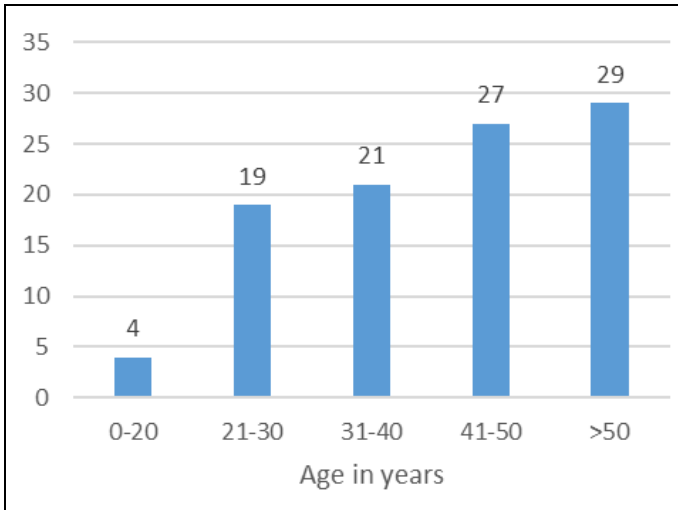
Outcome Variables
- Preop Scoring based on Predictive factors.
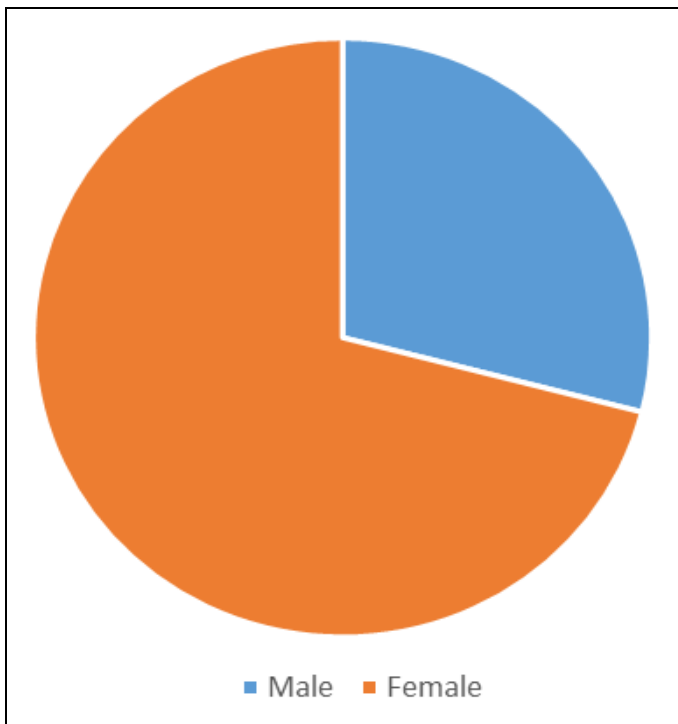- Intraoperative Difficulty in Laparoscopic Cholecystectomy

Observation and Results
This study is to evaluate the Scoring method for Preoperative prediction of Difficult laparoscopic cholecystectomy by Randhawa *et al*. 100 cases of elective Laparoscopic Cholecystectomy done in a single surgical unit operated by a single surgeon in SMS Medical College and attached hospital, Jaipur were included for the study from June 2018 to December 2019

Demography

Graph 1: Age Distribution

Graph 2: Sex Distribution

In our study, the mean age was 44.59 years (range: 16–70 years). Most patients were in the age ≤50 years (67) and 33% were > 50 years. Cholelithiasis being a common disease of female was reflected in our study too. 71 out of 100 cases were female**.**
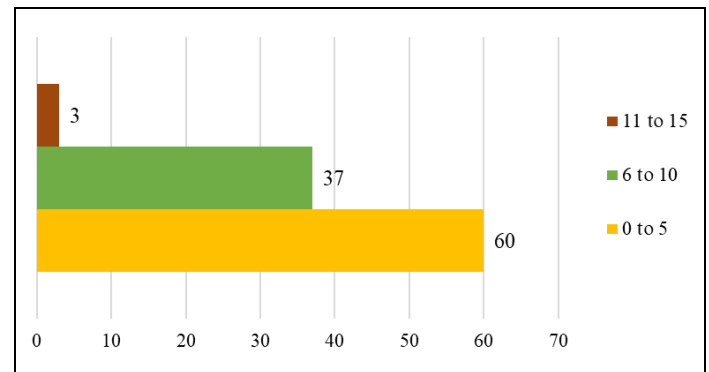
Pre-Operative Predictors
Randhawa *et al.* developed a scoring system with 9 predictive factors. The distribution of the predictive factors in our cases is given below.
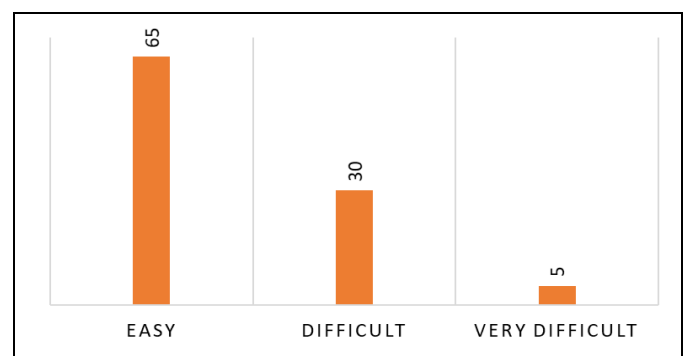
Table 3: Pre-operative predictors

Parameters		Frequency
Age in years	<50	61
	>50	39
Sex	Male	29
	Female	71
BMI kg/m2	<25	84
	25-27.5	13
	>27.5	3
H/o Hospitalisation	Yes	37
	No	63
Palpable gall bladder	Yes	18
	No	82
Abdominal Scar	Yes	22
	No	78
Impacted stone	Yes	43
	No	57
Gallbladder wall Thickness	>4mm	33
	<4mm	67
Pericholecystic Collection	Yes	17
	No	83

Prediction of ease of surgery were made as 0 to 5 being easy, 6 to 10 being difficult and 11 to 15 being very difficult.

60 cases were predicted to be easy, 37 cases to be difficult and 3 cases to be very difficult

Graph 3: Distribution of Scores

Graph 4: Intra operative grading

Intra operative difficulty was accessed on parameters – Operative time, Stone/Bile spillage, Injury to duct and Conversion. Distribution of these parameters are as follows.

Table 4: Intra operative findings

Parameters		Frequency
Time in mins	<60	64
	60-120	31
	>120	5
Bile/Stone Spillage	Yes	35
	No	65
Injury to duct	Yes	0
	No	100
Conversion	Yes	5
	No	95

Very difficult were cases requiring conversion or taking >120mins. Difficult cases were cases requiring 60-120 mins, with bile/stone spillage and duct injury. Cases under 60mins, with no bile/stone spillage and duct injury were classified as easy.

Intraoperatively 65 cases were easy, 30 were difficult and 5 were very difficult.

Correlation of Difficult Laparoscopic Cholecystectomy with Age

Table 5: Age as a predictive factor

| | Level | Preoperative outcome | | P value |
| | | Difficult | Easy | |
		Cases (35)	Cases (65)	
Age	<50 years	11	50	$P<0.001$ (S)
	≥50 years	24	15	

There is significant association of increasing age with difficulty in our study. ($P<0.001$)

Correlation of Difficult Laparoscopic Cholecystectomy with Sex

Table 6: Sex as a predictive factor

| | Level | Preoperative outcome | | P value |
| | | Difficult | Easy | |
		Cases (35)	Cases (65)	
Sex	Male	16	13	0.013 (S)
	Female	19	52	

This table shows that there is significant association (p=0.0130) between male sex and difficult dissection intraoperatively.

Correlation of Difficult Laparoscopic Cholecystectomy with Body Mass Index (BMI)

Table 7: BMI as a predictive factor

| | Level | Preoperative outcome | | P value |
| | | Difficult | Easy | |
		Cases (35)	Cases (65)	
BMI	<25	28	56	0.056 (NS)
	25.1-27.5	4	9	
	>27.5	3	0	

The association between BMI and difficult dissection was not statistically significant (p=0.056).

Correlation of Difficult Laparoscopic Cholecystectomy with Hospitalization

Table 8: Hospitalisation as a predictive factor

| | Level | Preoperative outcome | | P value |
| | | Difficult | Easy | |
		Cases (35)	Cases (65)	
Previous Hospitalization	Yes	28	9	$P<0.001$ (S)
	No	7	56	

There is significant association between previous history of admission and difficult dissection.

Correlation of Difficult Laparoscopic Cholecystectomy with Abdominal Scar

Table 9: Abdominal scar as a predictive factor

| | Level | Preoperative outcome | | P value |
| | | Difficult | Easy | |
		Cases (35)	Cases (65)	
Abdominal scar	Yes	5	17	0.266 (NS)
	No	30	48	

There is no significant association between history of previous lower abdominal surgery and difficult dissection.

Correlation of Difficult Laparoscopic Cholecystectomy with Palpable Gall Bladder (GB)

Table 10: Palpable GB as a predictive factor

| | Level | Preoperative outcome | | P value |
| | | Difficult | Easy | |
		Cases (35)	Cases (65)	
GB palpable	Yes	7	11	0.913 (NS)
	Nil	28	54	

There is no significant association between palpable gall bladder and difficult dissection.

Correlation of Difficult Laparoscopic Cholecystectomy with GB Wall Thickness

Table 11: GB wall thickness as a predictive factor

| | Level | Preoperative outcome | | P value |
| | | Difficult | Easy | |
		Cases (35)	Cases (65)	
GB wall thickness	Normal (<4mm)	8	59	$P<0.001$ (S)
	Thickened (>4mm)	27	6	

There is significant association between thickened gall bladder wall and difficult dissection.

Correlation of Difficult Laparoscopic Cholecystectomy with Impacted Stone

Table 12: Impacted stone on USG as a predictive factor

| | Level | Preoperative outcome | | P value |
		Difficult Cases (35)	Easy Cases (65)	
Impacted stone at neck of GB	Yes	31	12	P<0.001 (S)
	Nil	4	53	

Impacted stone on ultra sound, had significant association with difficult dissection.

Correlation of Difficult Laparoscopic Cholecystectomy with Pericholecystic Collection

Table 13: Pericholecystic collection as a predictive factor

| | Level | Preoperative outcome | | P value |
		Difficult Cases (35)	Easy Cases (65)	
Pericholecystic collection	Yes	15	2	P<0.001 (S)
	Nil	20	63	

There is significant association between pericholecystic collection and difficult dissection.

Correlation of Preoperative Score and Intraoperative Difficulty in Laparoscopic Cholecystectomy (LC)

Table 14: Correlation of pre op score and intraoperative difficulty in LC

Pre-Op Score	Easy	Difficult	Very Difficult	Total
0-5	59	1	0	60
6-10	6	29	2	37
11-15	0	0	3	3
Total	65	30	5	100

Out of total 100 cases 63 cases (63%) had pre op score between 0-5 all were undergo simple cholecystectomy. Pre op score between 6-10, 3 was found easy, 32 were found difficult and 2 were found very Difficult.3 patients had Pre op score between 11-15, they were had very difficult surgery and convert to open cholecystectomy.

Discussion

The advantages to the patients and the economic benefits of laparoscopic cholecystectomy to the society and the health care systems have been well documented [3]. The inherent technicalities involved in the laparoscopic procedure make laparoscopic cholecystectomy more difficult in certain patients. Severe inflammation as in the case of acute cholecystitis, also makes it difficult to define the anatomy of Calot's triangle and is also associated with increased bleeding due to high vascularity of the area. Chances of encountering an aberrant anatomy, are the same as those encountered during open cholecystectomy (OC). Thus, conversion to OC is inevitable in some cases [5].

Advantages of accurate prediction of difficulty in laparoscopic cholecystectomy include appropriate patient information, adequate surgeon preparation and proper operation scheduling, efficient hospital admission and bed usage and administrative planning and selection of patients for surgeons in the early learning phase and resident training. Understanding the risk of conversion allows the patient to make a better informed decision about the surgery [6]. Hence, patients expected to have a difficult operation or who have more chances of conversion to OC should be well informed about these risks. A well informed patient can adjust his or her expectations accordingly and unpleasant surprises or the disappointment of a large incision can be minimized. Early conversion in such patients is proved to decrease postoperative morbidity [7]. Difficult operation can also be scheduled early in the operation theatre day. Such patients should be operated by more experienced surgical team. Preoperative prediction of a difficult cholecystectomy and the risk of conversion can help the surgeon to provide better surgical care to the patient [8]. In our study we decided to evaluate the efficacy of the elaborate scoring method developed by Randhawa *et al.* in 2009 based on history, clinical and sonological findings. The proposed scoring system was said to be reliable with a sensitivity and specificity of 75.00% and 90.24%, respectively [4]. Our study has assessed the scoring method for its efficacy as well as the predictive factors of difficulty laparoscopic cholecystectomy

In our study (39/100) of the patients presented in 4th, 5th and 6th decade of life that is 39% of total patient and more then half number of difficult laparoscopic cholecystectomies (24/35) that is 68.5% are also in this age group. We found significant correlation between age and difficulty level of surgery. (*p*<0.05). Randhawa *et al.* in 2009 in their study reported age range from 9 to 71 years with mean age of 44.37 years. Maximum cases in this study was in the age group 30-50 years (54.4%) [4]. Yol S *et al*. [9] in their study didn't find association with the conversion rate. This varied opinion could be attributed to surgeon's experience and expertise. Increased difficulty level may be attributed to recurrent mild attacks of cholecystitis leading to adhesions and fibrosis.

In our study, there were 29 males and 71 females. 55.17% male cases (16 out of 29) turned out to have difficult procedure. Male sex is a significant predictive factor for Difficult LC. Nidoni R *et al.* in their study also found conversion rate in males was significantly higher compared to females (p = 0.034, 95% confidence interval) [10].

Nidoni R. *et al.* also found higher conversion rates in males over females (21% vs 4.5%) [10]. But it was not statistically significant (p-0.571).

Regarding obesity, laparoscopic surgery is difficult owing to various factors, such as port placement in obese patients takes longer time owing to the thick abdominal wall, dissection at the Calot's triangle is also technically difficult owing to the obscure anatomy because of excessive intraperitoneal fat, and there is difficulty in the manipulation of instruments through an excessively thick abdominal wall [11].

In our study, 13 Patients having BMI>25.1-27.5, 4 out of them had difficult surgery. 3 Patients having BMI greater than 27.5 was had difficult surgery. But overall in our study BMI is non significant risk factor (p-0.056). However, Lal P *et al.* in their study [12] have found BMI >30 to be significantly associated with difficulty in umbilical port entry and creating pneumoperitoneum. Patients with history of hospitalization for repeated attacks of acute cholecystitis had been shown to have high chances of difficult laparoscopic cholecystectomy due to dense adhesions at Calot's triangle and gallbladder fossa [12].

In our study 37 patients having history of previous hospitalization for acute cholecystitis and post ERCP pancreatitis. Out of them, 28 patient had difficult surgery and 5 patents were converted to open cholecystectomy. It is significant predictor of difficult laparoscopic cholecystectomy (p-0.001). Ishizaki Y *et al*. have reported that previous attack of acute cholecystitis significantly increased the difficulty in dissection of gall bladder from the liver parenchyma [13]. Similar findings

were also noted in a study by Chen RC *et al.* [14]

It is presumed that previous abdominal surgery; especially upper abdominal surgery may cause difficulty due to periumbilical and peri gallbladder adhesions. Agarwal N *et al.* reported that previous abdominal surgery poses problems during creation of pneumoperitoneum and during adhesiolysis to gain adequate exposure to the operative field [15].

In our 22 patients had history of previous surgeries but lower abdominal scars mainly of previous tubal ligation and hysterectomy in female patients, none of them had upper abdomen scar. Only Five (22.7%) patients out of 22 had history of previous abdominal surgery (three had history of LSCS and two had hysterectomy) had difficult LC. No statistically significant correlation (p=0.266) between history of previous abdominal surgery and intraoperative difficulty was found.

In our study, thickened gall bladder wall was found to be a significant predictor of difficulty in laparoscopic cholecystectomy (*p*<0.001). 77% of the difficult patients had a thickened gall bladder wall as compared to 10.16% of the easy patients. Such patients were found to have a more chance of having a difficult laparoscopic cholecystectomy as compared to patients without thickened gall bladder wall. All the five converted patients had thickened gall bladder wall. According to Curet MJ *et al.* patients with thickened gall bladder wall have 8 times more chances of conversion to OC. [16] They have associated a thickened gall bladder wall with difficulties in exposure of biliary anatomy. These factors contributed to difficulties in retraction and increased chances of liver tears and bleeding from gallbladder bed, thus causing increased bleeding in these patients. A consequent increase in operating time was also noticed [16].

In our study, impacted stone at GB neck was found to be a significant predictor of difficulty in laparoscopic cholecystectomy (*p*<0.001). 88.5% of the difficult patients had an impacted stone at GB neck as compared to 18.46% of the easy patients. According to Habib FA *et al.* patients with impacted stone at GB have 6 times more chances of conversion to OC [17]. They have associated a distended GB and difficulties in holding and retraction of GB. These factors contributed to difficulties in exposure of biliary anatomy and increased chances of liver tears and bleeding from gallbladder bed, thus causing increased bleeding in these patients. A consequent increase in operating time was also noticed.

Pericholecystic collection was found to be a predictor of difficult laparoscopic cholecystectomy. In our study 17 patients out 100 had pericholecystic collection and 42.85% of difficult patients had pericholecystic collection. There was a significant correlation between pericholecystic collection and the difficulty level of surgery. (p=<0.001)

Clinically palpable GB may be due to distended GB, mucocele of GB, thick-walled or owing to adhesions between the GB and the omentum. In our study, 18 patients had palpable GB, 7 of them had a difficult LC and 11 patient had easy LC. However, it was not statistically significant in (P=0.913). Contrary to this Zuker KA *et al.* in their study found palpable GB to be predictor of difficult LC [18].

In our study out of total 100 patients undergoing laparoscopic cholecystectomy. Easy cholecystectomy was performed in 65 patients with mean duration of surgery is 44.30 minutes. Difficult cholecystectomy was encountered in 35 patients with mean duration of surgery is 87.57 minutes and Conversion to open happened in 5 laparoscopic surgeries with mean duration of surgery is 131 minutes. Micheal R *et al.*, reported longer duration of surgery is due to time required for removal of

inflammatory pericholecystic adhesion, intra-operative gall bladder decompression and longer learning curve [19]. Sanabria JR *et al.* reported severe adhesions in calot's triangle are most serious problem among all DLC cases. They have longer operation time and higher conversion rate [20, 21]. In our study five patients required conversion to open cholecystectomy. Thus a conversion rate of 5% was observed. This is in accordance with the conversion rates observed in most recent series (3 to 5%). All five patients were converted electively .Of these 3 cases were preoperatively scored to be very difficult. The other 2 cases however had a score 10 and were deemed difficult.
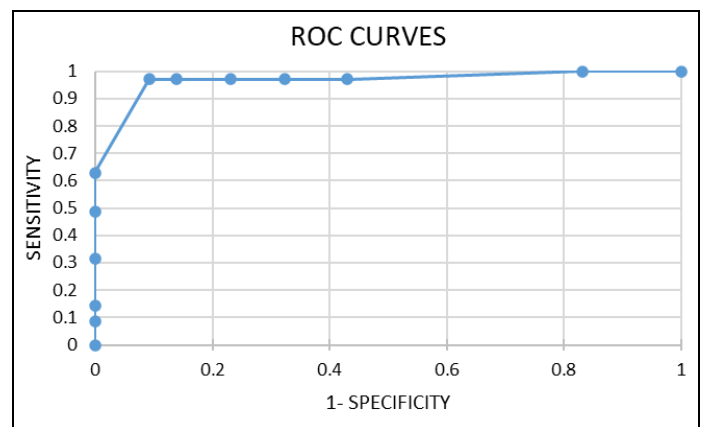
Evaluation of the Scoring Method
The efficacy of Randhawa *et al.* scoring system in preoperative prediction of difficult laparoscopic cholecystectomy was evaluated in our study.
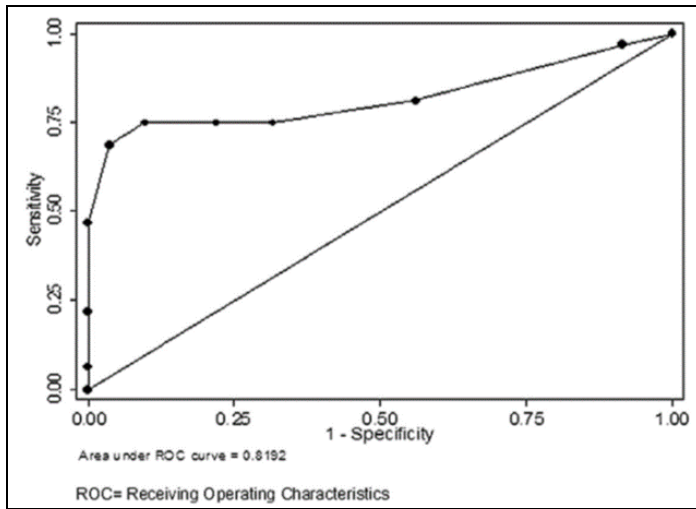
Table 15: Efficacy of the Scoring System

	Easy	Difficult	Very Difficult	Total
Sensitivity	90.77	96.67	60	91
Specificity	97.14	88.57	100	95.5
PPV	98.32	78.38	100	
NPV	85	98.41	97.9	

[PPV Positive predictive value, NPV Negative predictive value]
Sensitivity and specificity of the scoring system along with PPV and NPV is depicted in the above table. The scoring system had an overall sensitivity and specificity of 91% and 95.5%. However, the sensitivity of the scoring system was low for very difficult LC. This may be due to various factors which play a role in the conversion. Like the 2 cases in our study that needed conversion despite prediction otherwise were due to patient comorbidities and the other due to inability to control bleeding.

Micheal R *et al.* also evaluated this scoring method. Sensitivity and specificity of the scoring system were 95.74% and 73.68% respectively in their study sample. Area under their ROC curve is 0.86. Randhawa *et al.* themselves had sensitivity and specificity of 75% and 90.24% respectively and area under ROC curve as 0.826. Our study found this scoring method to be more sensitive than previous studies. However,positive predictive value for very difficult cases was less when compared to the findings published by Randhawa *et al.*

Receiver Operating Characteristic (ROC) Curve was plotted for the prediction of difficult LC at score 5 and curve yielded an Area Under The Curve (AUC) of 0.964. This implies high efficacy of the test.

Graph 15: Our ROC Curve

Graph 16: Randhawa *et al.* ROC Curve

Area under curve in our study (AUC= 0.964) is more than the AUC in original study by Randhawa *et al*. The efficacy of the scoring system is high with high Sensitivity and Specificity.

Summary and Conclusion
Hundred patients presenting for laparoscopic cholecystectomy to Department of General Surgery, SMS Medical College & attached Hospital, Jaipur were studied prospectively for presence or absence of preoperative risk factors as predictors of difficult laparoscopic cholecystectomy. Significant risk factors were further analysed in terms of their association with the type of difficulty.

Preoperative risk factors studied were increased age, male sex, increase BMI, history of hospitalization, palpable gall bladder, impacted stone in GB, thickened gall bladder wall and pericholecystic collection on preoperative ultrasound, previous history of upper and lower abdominal surgery.

Six of the risk factors among the pre-operative predictors were found to be statistically significant as independent risk factors. These are increased age, male sex, history of hospitalization, impacted stone in GB, thickened gall bladder wall and pericholecystic collection on preoperative ultrasound.

Probability of encountering difficulty during surgery was significantly increased in patients with an impacted stone in GB, thickened gall bladder wall and pericholecystic collection on preoperative ultrasound. 72.09% patients with

thickened GB, 88.5% patients with impacted stone in gall bladder and 88.2% patients with pericholecystic collection had difficult operations. The difficulties encountered were adhesions, bleeding and a consequently increased operating time.

Five cases needed conversion in our study. Preoperative scores of these cases correctly predicted difficult cholecystectomy. Three patients with pre op score >10 were even predicted to have conversion.The scoring system had an overall sensitivity and specificity of 91% and 95.5%. as compared to original Randhawa *et al.* study with sensitivity and specificity of 75% and 90.24%.

To conclude, we evaluated and found the Randhawa *et al.* scoring method as a good test for pre-operative predicting the difficulty of laparoscopic cholecystectomy. However, the small sample size may be an impediment in attaining complete statistical validity which is reflected in the lower sensitivity in predicting conversion while having high PPV and NPV. Preoperative prediction of a difficult cholecystectomy and the

risk of conversion is of great help both to the patient who can plan his work and the surgeon who can also schedule his time and team accordingly prior to taking the patient to the operation theatre. This would help to provide better surgical care to the patient. We propose large scale, multicentric studies to determine additional factors which might play a role in outcome, to validate the scoring methodology and to establish its efficacy.

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