ORIGINAL ARTICLE

Preoperative Scoring System to Predict Difficult Laparoscopic Cholecystectomy

Sajay Reddy[1], Sreeramulu PN[2]

Abstract

Background: Laparoscopic cholecystectomy (LC) is considered as the most common laparoscopic procedure in the world and is now the Gold standard treatment for cholelithiasis. Gallstone disease (cholelithiasis) has increasingly become one of the major causes of abdominal pain and discomfort in the developing world. Its occurrence has been found to be high (7.4%) in the adult population in the cities of Chandigarh and New Delhi in North India, which is one of the highest in the world. Gallstones are more common in the female population (61%) as compared to males (39%). The most common age-group affected is 45–60 years (38.5%) among females and above 60 years in males (20.8%). A relatively higher prevalence of 39% among males when compared to reports from past studies indicates a significant shift in the pattern of prevalence of gallstone disease. Many risk factors for cholelithiasis cannot be modifiable, such as ethnic background, advancing age, female gender, family history or genetics. The modifiable risks for cholelithiasis are obesity, quick weight loss, an idle lifestyle. A rising epidemic of obesity and the metabolic syndrome predicts an escalation in gallstones. Frequent risk factors for biliary sludge include pregnancy, drugs like ceftriaxone, octreotide, and thiazide diuretics, total parenteral nutrition, and fasting. Diseases like cirrhosis, chronic hemolysis, and Crohn's disease are a few risk factors for black pigment stones. In our hospital setup (RL Jalappa Hospital and Research Center, Tamaka, Kolar, Karnataka), in the Department of Surgery, a total of 166 cholecystectomies were performed in the period between October 2015 and September 2018. In total, 134 of these cases were elective laparoscopic cholecystectomy and twenty five of them were elective open cholecystectomies. There were a total of 7 cases that had to be changed from laparoscopic to open procedure due to intraoperative difficulty involved. That gives us a conversion rate of 4.96% over the past 3 years in our hospital setup. Preoperative prediction for the likelihood of conversion to open or difficulty of operation is an important aspect of planning laparoscopic surgery as the prevalence of gallbladder disease is increasing in India, and laparoscopic surgery is becoming more accessible. Arogya Karnataka Scheme, which can be used in our hospital setup, has laparoscopic cholecystectomy as one of its schemes for impoverished patients bringing the chance of laparoscopic surgery to the public. As a result, the number of laparoscopic cholecystectomies as a whole as well as the risk of conversion increases, making the need for study all the more important.

Aims and objectives: (1) To validate that a scoring system based on history, physical examination, and ultrasonographic findings is a reliable predictor of the difficulty of laparoscopic cholecystectomy. (2) To help in choosing a favorable treatment modality depending on the score. (3) To help predict the duration of hospital stay and postoperative complications with the help of this system.

Methods: A prospective and comparative study, considering 70 patients admitted and undergoing laparoscopic cholecystectomy at RL Jalappa Hospital and Research Center attached to Sri Devaraj Urs Academy of Higher Education Tamaka, Kolar, during the period of November 2018 and 10th October 2020.

Results: The preoperative scoring system devised is excellent at predicting the intraoperative difficulties encountered by surgeons while performing laparoscopic cholecystectomy with a sensitivity of 88.9% and a specificity of 92.3%. The scoring system also predicted intraoperative complications with a specificity of 94.2% when the score is >7. There was also a very strong correlation between the preoperative score and the duration of surgery ($r = 0.752$, $p < 0.001$) and also between the preoperative score and the duration of hospital stay ($r = 0.788$, $p < 0.001$).

Conclusion: Preoperative prediction of the risk of conversion or difficulty of operation is an important aspect of planning laparoscopic surgery. I would conclude that the scoring system evaluated in our study can be used to predict difficult cases.

Keywords: Cholecystectomy, Laparoscopic, Predictive factors, Preoperative, Scoring system.

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Introduction

Gallbladder diseases are a relatively common disorder in large parts of the world. The prevalence of cholelithiasis in the USA and much of Western Europe is between 10 and 20%.[1,2] The prevalence is seen to increase with age in both sexes. However, it has been observed around the world that gallbladder diseases are predominantly a disease affecting females.

In India too, the gallstone disease follows the pattern seen in Western countries and is relatively common with overall prevalence in the order of 10–20%[3] and affecting females predominantly.[4,5] The results in this issue of the journal by Gaharwar et al.[6] are no different.

There is a difference in the burden of gallbladder diseases between Northern and Southern states in India (commoner in North), a phenomenon which is poorly understood.[5–8] The pattern of prevalence of gallstone disease has seen a significant shift when compared to past studies, with a higher than expected prevalence of 39% among males.[9]

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Advancing age, ethnic background, family history, female gender, and or genetics are some risk factors for cholelithiasis which cannot be modified. The risks which can be modified for gallstones are an idle lifestyle, sudden weight loss, and obesity. A rise in gallstone frequency is expected with the rising epidemic of obesity and its associated metabolic syndrome. Drugs such as thiazide diuretics, ceftriaxone, octreotide, pregnancy, total parenteral nutrition, and fasting are some of the risk factors for biliary sludge. Chronic hemolysis, cirrhosis, and Crohn's disease are a few risk factors for the formation of black pigment stones.[10]

The first cholecystectomy was performed on a patient who suffered from cholelithiasis by Carl Johann August Langenbuch, who pioneered Cholecystectomy in 1882. It has since been considered the surgery of choice for gallstone disease (cholelithiasis). The gold standard for treatment of most of the gallbladder diseases is considered to be LC. Shorter duration of hospital stay, less postoperative pain, faster return of bowel function, better cosmesis, and also quicker return to full activity are some of the advantages of LC.

Although LC is the gold standard, there are instances of LC, when the surgery becomes difficult. There are instances of surgery taking a longer than expected duration with bile/stone spillage, iatrogenic injury of common bile/hepatic duct, and thickly adherent gallbladder, and occasionally some surgeries require conversion to open cholecystectomy (OC). Predicting preoperatively, the degree of difficulty of surgery is a nigh impossible task with many confounding factors. There is no standardized and widely recognized scoring system available to predict the difficulty of LC preoperatively at present. In my study, we have attempted to devise a scoring system for predicting the difficulty in LC preoperatively using easily available parameters and correlating the same with our observed intraoperative findings and difficulty encountered. My study attempts to recognize the factors which help to predict increased difficulty in LC, and thus surgical complications can be predicted and necessary precautions taken or altogether prevented.

Preoperative Predictive Factors

In our study, the preoperative degree of difficulty is assessed by taking the following factors into consideration, and it is compared with our intraoperative observations and experiences. Patients with gallstone disease confirmed on ultrasound scan will be posted for LC. The following patient factors are evaluated preoperatively: *History* – History of previous hospitalization for cholecystitis, sex, and age; *Clinical findings* – Palpable gallbladder, abdominal scar, and BMI; *Sonology findings* – wall thickness, impacted stone, and pericholecystic collection.

In a study conducted by Mittalgodu Anantha Krishna et al. at Kasturba Medical College, Manipal University, Mangaluru, which tried to establish a predictive scoring method for difficult LC, they used a number of USG, preoperative and intraoperative parameters analyzed against the endpoint of difficult LC. Our study uses far fewer parameters and aims for similar results.[11]

History

- H/o previous hospitalization (abdominal surgeries/cholecystitis/pancreatitis)
- Age
- Sex

HISTORY			MAX SCORING
AGE	<50 yrs (0)	>50 yrs (1)	1
Sex	Female	Male(1)	1
H/O Hospitilisation	N (0)	Y(4)	4
BMI	<25 (0)	25-27.5(1) >27.5 (2)	2
Abdominal Scar	N (0)	Infraumblical (1) Supraumblical (2)	2
Palpable GB	N(0)	Y(1)	1
Wall Thickness	Thin (0)	Thick>4 mm(2)	2
Pericholecystic Collection	N (0)	Y(1)	1
Impacted Stone	N (0)	Y(1)	1

Maximum score -15
Score upto 5 - easy,
6–10 - difficult
11–15 - very difficult

Fig. 1: Preoperative scoring system with the various parameters and their respective scores

Clinical

- Abdominal scar infraumbilical or supraumbilical
- Palpable gallbladder
- BMI

Imaging

- Pericholecystic collection.
- Impacted stone.
- Gallbladder wall thickness.
- These factors were selected based on the previous studies and their respective association with LC (Fig. 1).[12,13]

Following evaluation, the patient will be subjected to LC. Factors noted are given as follows:

- Biliary/stone spillage.
- Operative time taken incision to port closure.
- Injury to duct/artery.
- Bleeding during surgery.
- Placement of drain.
- Need for conversion regarding upon the difficulty of the case.

Accordingly the cases are classified into one of the following categories:

Easy

- Time taken is <60 min
- No injury to duct, artery
- No bile spillage

Difficult

- Time taken is 60–120 min
- Injury to duct
- Bile/stone spillage
- No conversion

Table 1: Validity of a test in screening of disease

Screening test results	*Diagnosis*		
	Diseased	*Healthy*	*Total*
Positive	a (True positive)	b (False positive)	a + b
Negative	c (False negative)	d (True negative)	c + d
Total	a + c	b + d	a + b + c + d

Very difficult

- Conversion
- Time taken is >120 min

All the cases have had preanesthetic fitness, a routine work-up, and were taken up for surgery by a single surgeon. The duration of surgery was calculated from incision to port closure. We have calculated the preoperative degree of difficulty using our predictive parameters and are going to compare the outcome to our intraoperative findings. Duration of hospital stay was also tabulated.

Results

Statistical Analysis

Data were entered into Microsoft Excel data sheet and were analyzed using SPSS 22 version software. Continuous data were represented as mean and standard deviation. Categorical data was represented in the form of frequencies and proportions. Chi-square test was used as test of significance for qualitative data (Table 1).[14–16]

- Sensitivity = a/(a + c) × 100 = True positive/True positive + False negative
- Specificity = d/(b + d) × 100 = True negative/True negative + False positive
- Positive predictive value = a/(a + b) × 100 = True positive/True positive + False positive
- Negative predictive value = d/(c + d) × 100 = True negative/True negative + False negative
- Diagnostic accuracy = a + d/a + b + c + d = True positive + True negative/Total

Specificity: It is the ability of a test to identify correctly those who do not have disease, i.e., true negative.
Sensitivity: Defined as possibility of a test to identify correctly all those who have the disease, i.e., true positive
Negative predictive value (NPV): The proportion of patients who test negative who are actually free of the disease.
Positive predictive value (PPV): The proportion of patients who test positive who actually have the disease.
Diagnostic accuracy: Is the ability of screening tests to detect true positives and true negatives in the total population studied.
p value: (Probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.
Graphical representation of data: MS Excel and MS word were used to obtain various types of graphs such as bar diagrams, Pie diagrams, ROC curve, and scatter plots.
Statistical software: MS Excel, SPSS version 22 (IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

In the study, 49 (74.2%) subjects were ≤50 years and 17 (25.8%) were >50 years, in which 46 (69.7%) were female and 20 (30.3%) were male. In total, 13 (19.7%) had previous history of hospitalization for cholecystitis, while 53 (80.3%) patients did not (Table 2) (Fig. 2).

Table 2: History parameters distribution (total number of patients = 66)

		Count	*%*
Age	≤50 years	49	74.2
	>50 years	17	25.8
Sex	Female	46	69.7
	Male	20	30.3
History of hospitalization for cholecystitis	No	53	80.3
	Yes	13	19.7

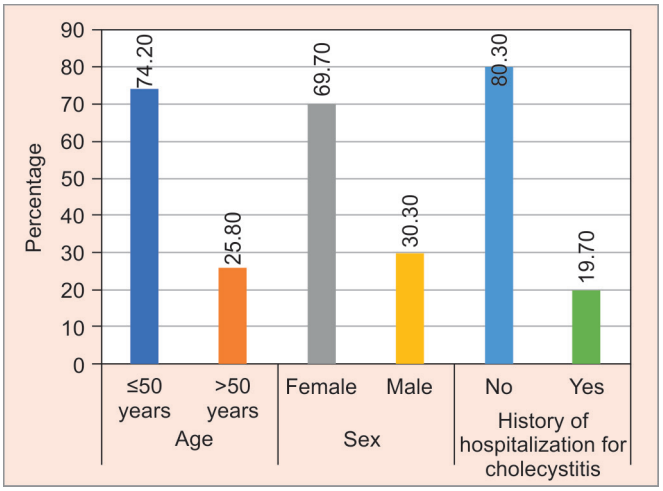

Fig. 2: Bar diagram showing history parameters distribution

Table 3: Clinical examination findings distribution (total number of patients = 66)

		Count	*%*
BMI	<25	21	31.8
	25–27.5	15	22.7
	>27.5	30	45.5
Abdominal scar	No	25	37.9
	Infraumbilical	31	47.0
	Supraumbilical	10	15.2
Palpable gallbladder	No	66	100.0

In the study, BMI was <25 in 21 (31.8%), 25–27.5 in 15 (22.7%), and >27.5 in 30 (45.5%) subjects. In total, 31 (47.0%) subjects had infraumbilical abdominal scar, while 10 (15.2%) had supraumbilical scar and 25 (37.9%) had none. No subject presented with a palpable gallbladder (Table 3, Fig. 3).

On sonologic findings, wall thickness was thin or <4 mm in 36 (54.5%) and thick ≥4 mm in 30 (45.5%). Pericholecystic collection was seen in 13 (19.7%) subjects, while 14 (21.2%) presented with an impacted stone (Table 4, Fig. 4).

In the study, as per the preoperative score system, 39 (59.1%) were predicted to have an easy procedure, 23 (34.8%) were predicted to have a difficult procedure, and 4 (6.1%) to have a very difficult one (Table 5, Fig. 5).

In the study, 11 (16.7%) had placement of drain (Table 6, Fig. 6).

There is a significant positive correlation between the preoperative score and the duration of surgery (p <0.001), and the duration of hospital stay.

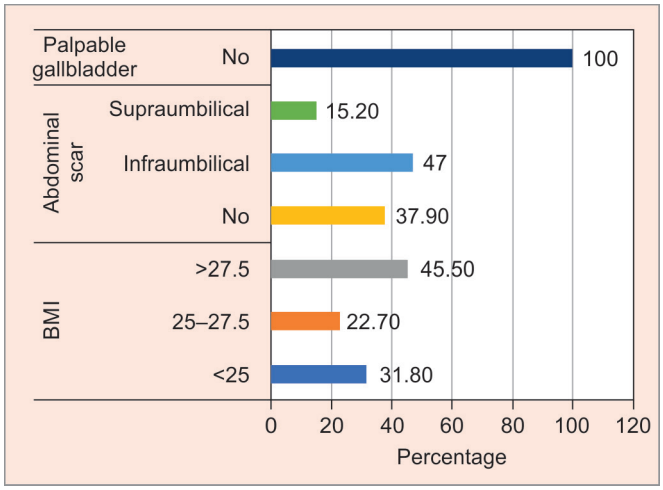

Fig. 3: Column diagram showing clinical examination findings distribution

Table 4: Sonologic findings distribution (total number of patients = 66)

		Count	*%*
Wall thickness	Thin <4 mm	36	54.5
	Thick ≥4 mm	30	45.5
Pericholecystic collection	No	53	80.3
	Yes	13	19.7
Impacted stone	No	52	78.8
	Yes	14	21.2

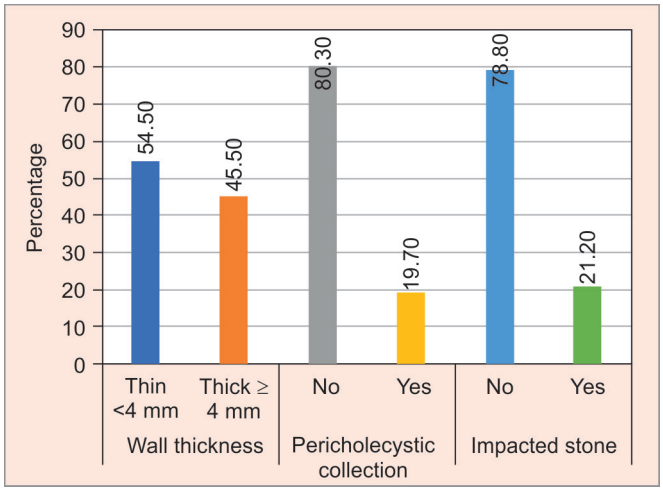

Fig. 4: Bar diagram showing sonologic findings distribution

Table 5: Preoperative scoring distribution (total number of patients = 66)

		Count	*%*
Preoperative score grading	Easy	39	59.1
	Difficult	23	34.8
	Very difficult	4	6.1

Out of 66 patients, 52 (78.8%) had no intraoperative complications, while 14 (21.2%) had intraoperative complications, 4 (6.1%) had iatrogenic perforation of the gallbladder, 3 (4.5%) had bleeding from cystic artery, 3 (4.5%) had thickly adherent gallbladder, 2 (3%) had spilled gallstones, 1 (1.5%) had bleeding from abdominal wall (port) and 1 (1.5%) had bleeding from tissues adjacent to the gallbladder (Tables 7 and 8, Figs 7 and 8).

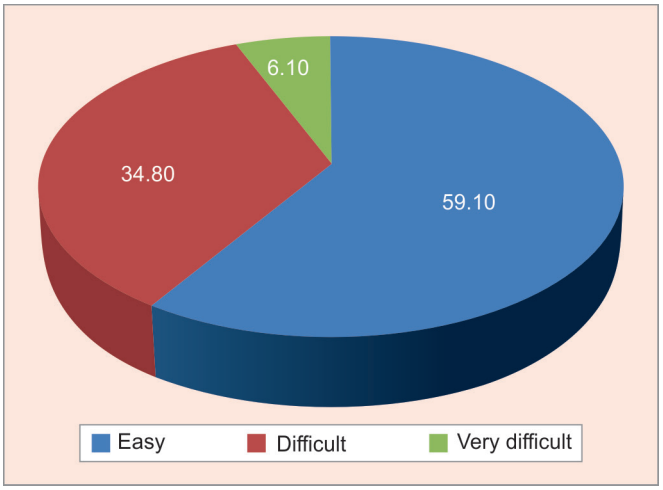

Fig. 5: Pie diagram showing preoperative score grading distribution

Table 6: Operative findings distribution (total number of patients = 66)

		Count	*%*
Placement of drain	No	55	83.3
	Yes	11	16.7

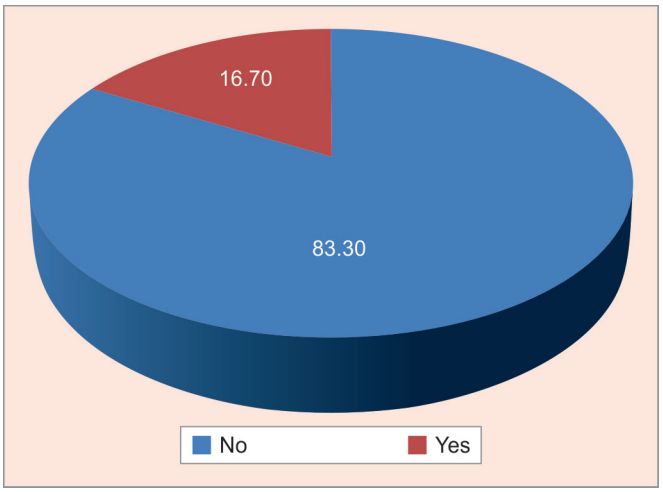

Fig. 6: Pie diagram showing placement of drain distribution

Operative outcome was easy in 39 (59.1%), difficult in 20 (30.3%), and very difficult in 7 (10.6%) subjects (Table 9, Fig. 9).

In total, 39 patients out of 66 were preoperatively predicted to have an easy cholecystectomy depending on their scores. In total, 36 (92.3%) patients in whom easy procedure was predicted preoperatively had an easy cholecystectomy. Only 3 (15%) had a difficult procedure in spite of being predicted otherwise, no patients with an easy grading underwent a very difficult procedure (Table 10, Fig. 10).

In total, 23 patients out of 66 were preoperatively predicted to have a difficult cholecystectomy depending on their scores. 17 (85%) of patients in whom difficult procedure was predicted preoperatively had an difficult cholecystectomy. 3 (7.5%) had an

Table 7: Correlation between preoperative score with duration of surgery and duration of hospital stay

		Preoperative score
Preoperative score	Pearson correlation (*r*)	1
	p-value	
	N	66
Duration of surgery (in minutes)	Pearson correlation (*r*)	0.752
	p-value	<0.001
	N	66
Duration of hospital stay	Pearson correlation (*r*)	0.788
	p-value	<0.001
	N	66

Table 8: Intraoperative complications distribution (total number of patients = 66)

		Count	*%*
Intraoperative complications	Bleeding from abdominal wall (port)	1	1.5
	Bleeding from cystic artery	3	4.5
	Bleeding from tissues adjacent to the gallbladder	1	1.5
	Iatrogenic perforation of the gallbladder	4	6.1
	Spilled gallstones	2	3.0
	Thickly adherent gallbladder	3	4.5
	None	52	78.8

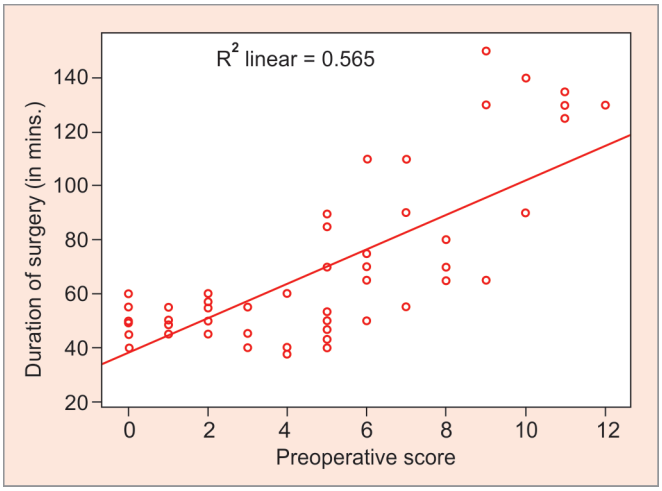

Fig. 7: Linear graph showing relationship between preoperative score and the duration of surgery

easy procedure and 3 (7.5%) had a very difficult procedure in spite of being predicted to be difficult.

In total, 4 patients out of 66 were preoperatively predicted to have a very difficult cholecystectomy depending on their scores. 4 (100%) of patients in whom very difficult procedure was predicted preoperatively had a very difficult cholecystectomy.

There was a significant difference in association between operative outcome and preoperative score (Table 11, Fig. 11).

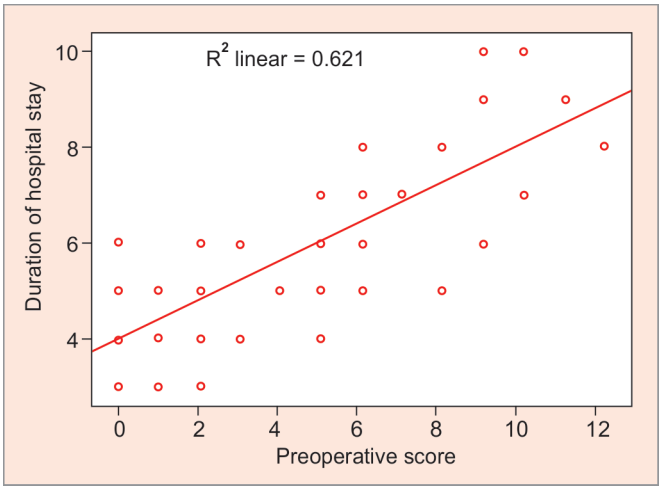

Fig. 8: Linear graph showing relationship between preoperative score and the duration of hospital stay

Table 9: Operative outcome distribution (total number of patients = 66)

		Count	*%*
Operative outcome	Easy	39	59.1
	Difficult	20	30.3
	Very difficult	7	10.6

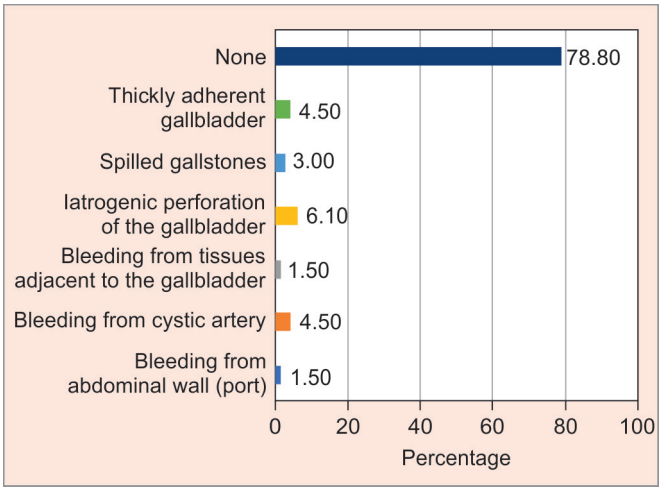

Fig. 9: Column diagram showing intraoperative complications and their distribution

Table 10: Association between operative outcome and preoperative score (total number of patients = 66)

		Operative outcome					
		Easy		*Difficult*		*Very difficult*	
		Count	*%*	*Count*	*%*	*Count*	*%*
Pre-operative score grading	Easy	36	92.3%	3	15.0%	0	0.0%
	Difficult	3	7.5%	17	85.0%	3	7.5%
	Very difficult	0	0.0%	0	0.0%	4	100%

$\chi^2 = 74.52$, df = 4, p <0.001*

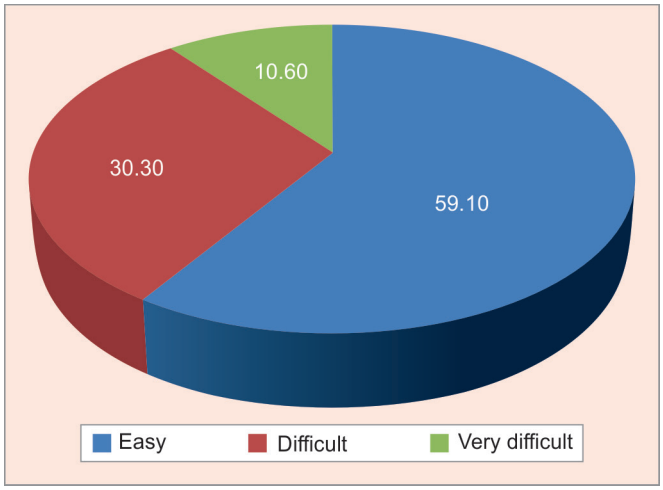

Fig. 10: Pie diagram showing operative outcome distribution

Table 11: Association between preoperative grade and operative outcome (total number of patients = 66)

		Operative outcome			
		Difficult		*Easy*	
		Count	*%*	*Count*	*%*
Preoperative grade	Difficult	24	88.9	3	7.7
	Easy	3	11.1	36	92.3

$\chi^2 = 43.51$, df = 1, p <0.001*

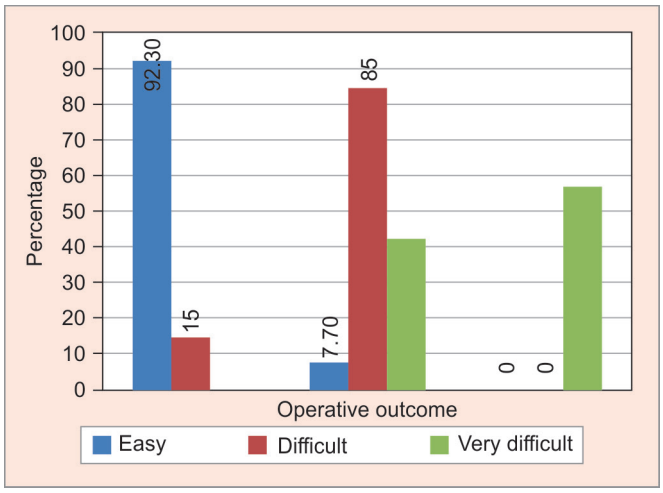

Fig. 11: Bar diagram showing association between operative outcome and preoperative score

Table 12: Association between preoperative grade and intraoperative complications (total number of patients = 66)

		Intraoperative complications			
		Yes		*No*	
		Count	*%*	*Count*	*%*
Preoperative grade	Difficult	12	85.7	15	28.8
	Easy	2	14.3	37	71.2

$\chi^2 = 14.75$, df = 1, p <0.001*

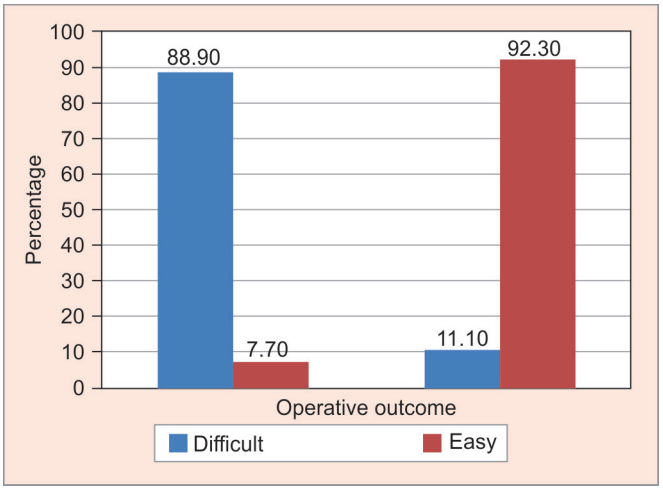

Fig. 12: Bar diagram showing association between operative outcome and preoperative score

Table 13: Validity of preoperative score in differentiating difficult and easy outcome (total number of patients = 66)

Area under the ROC curve (AUC)	0.962
Standard error	0.0194
95% confidence interval	0.883–0.993
z statistic	23.825
Significance level *p* (area = 0.5)	<0.0001

Difficult and very difficult outcomes in operative outcome were clubbed. In total, 6 cases were outliers during the study with respect to the preoperative score and intraoperative outcome

Operative outcome was predicted correctly as difficult in 88.9% and easy in 92.3%. 11.1% (3) had difficult operative outcome when the preoperative grade was easy. 7.7% (3) had easy operative outcome when preoperative grade was difficult.

There was a significant difference in association between preoperative grade and operative outcome.

Intraoperative complications were seen in 14 of the 66 test subjects. 12 (85.7%) of these subjects had a preoperative grade which predicted a difficult procedure. In 2 (14.3%) of these subjects, intraoperative complications were encountered in spite of a preoperative prediction of easy procedure (Table 12, Fig. 12).

There was a significant difference in association between preoperative grade and intraoperative complications (Table 13, Fig. 13).

The curve shows a sensitivity of 88.9% and a specificity of 92.3% at a preoperative score of >5, which is very significant and shows that the scoring system is a very good predictor of operative outcome (Table 14, Fig. 14).

The curve shows a very high specificity of 94.2% at a preoperative score of >7 for predicting intraoperative complications (Fig. 15).

Discussion

Fillipi, Mall, and Roosma in 1985 first demonstrated Laparoscopic Cholecystectomy in an animal model in 1985.[17] In 1987, the first

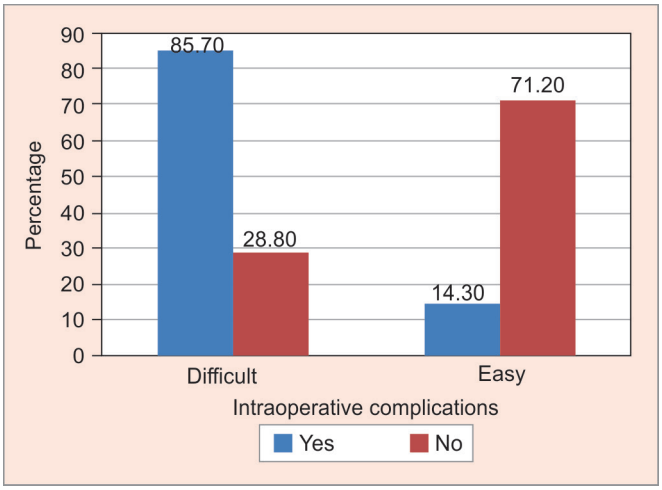

Fig. 13: Bar diagram showing association between preoperative grade and intraoperative complications

Table 14: Validity of preoperative score in predicting intraoperative complications (total number of patients = 66)

Area under the ROC curve (AUC)	0.900
Standard error	0.0421
95% confidence interval	0.802–0.960
z-statistic	9.508
Significance level *p* (area = 0.5)	<0.0001

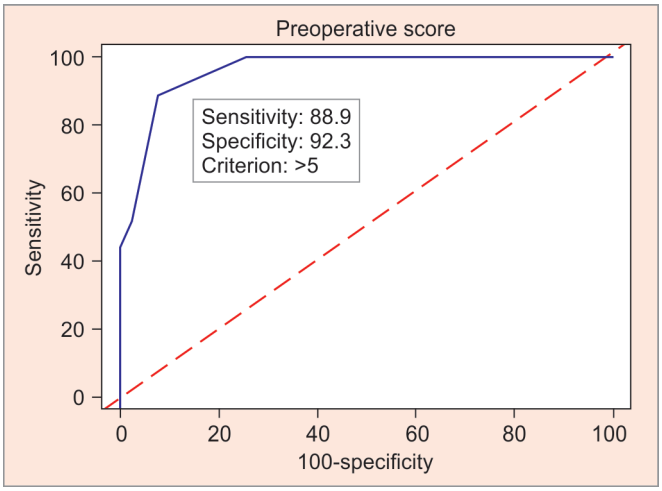

Fig. 14: ROC curve showing validity of preoperative score in differentiating difficult and easy outcomes

Laparoscopic cholecystectomy was successfully performed on a human subject suffering from cholelithiasis by Philip Mouret in 1987 using an unmagnified mechanical rigid pipe without doing laparotomy to remove the gallbladder.

The complication rate with LC was high initially but has now reached a remarkably low level at 2.0–6.0% with an increase in the expertise of the procedure and technological advancement.[18] A rate of 7–35% conversion to open cholecystectomy has been reported in literature.[19]

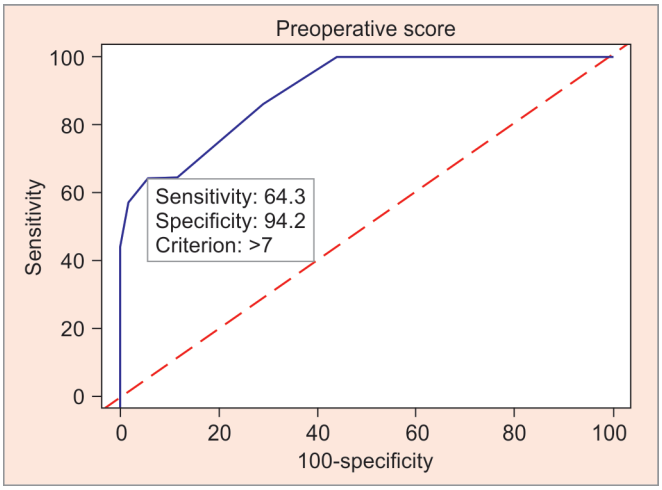

Fig. 15: ROC curve showing validity of preoperative score in predicting intraoperative complications

Laparoscopic cholecystectomy is the gold standard treatment of choice for gallbladder disease (mainly symptomatic cholelithiasis).[20] Utmost caution has to be exercised while performing the procedure as this treatment is not devoid of complications, albeit it is lower in experienced hands.[21] My study was aimed to develop a scoring method for difficult LC with a secondary objective of correlating preoperative predictive factors with intraoperative difficulty in LC by assessing the various preoperative predictors (history/clinical imaging). A study of 66 subjects to understand the preoperative predictors of difficult LC revealed that the majority of them were below or equal to 50 years of age (74.2%, *n* = 49), and most of them were females (69.7%, *n* = 46). A majority of the patients were obese, with 30 (45.5%) with a BMI >27.5 and 15 (22.7%) with a BMI between 25 and 27.5 kg/m^2. In total, 41 out of 66 patients had abdominal scars from previous operations, in which 31 (47%) had an infraumbilical scar, and 10 (15.2%) had a supraumbilical scar. On sonologic examination, 30 (45.5%) patients had a gallbladder wall thickness of more than or equal to 4 mm, while 13 patients showed pericholecystic collection and 14 patients had impacted stones.

In our study, we developed a scoring system to preoperatively ascertain the difficulty in LC based on clinical findings, history, and sonology. The grades were categorized as easy (<5), difficult (5–10), and very difficult (11–15). In total, 57 out of 66 cases were predicted correctly by our scoring system (86.36%).

Randhawa et al.[22] in 2009 (88–92%, easy to difficult) and Dhanke et al.[23] in 2014 (94.05–100%, easy to difficult) published similar findings.

Higher BMI – 22 (73.3%) patients out of 30 with a BMI of >27.5 kg/m^2 had difficult cholecystectomies. Gallbladder thickness >4 mm also correctly predicted difficult cholecystectomies with findings in 23 (76.6) patients, previous history of hospitalization for cholecystitis also showed a positive correlation between it and difficulty in surgery with 11 (84.6) out of 13 patients having difficult cholecystectomies. Pericholecystic collection was the parameter with the highest association with difficulty in laparoscopy, 12 (92.3%) out of 13 patients with collections underwent difficult procedures. History of prior hospitalization, high BMI, and pericholecystic collection are predictors of the difficulty of laparoscopic cholecystectomy as described by Dhanke et al.[23] in 2014 with whom our study is in agreement with. In 2005, Nachnani

et al.[24] also reported that previous history of hospitalization, GB thickness >3 mm, and BMI >30 kg/m^2 are good predictors of the level of difficulty in LC.

In my study, no cases were converted into open. This is a large variation as compared to 27.9% (Oymaci et al., 2014), 19 cases (17%) by Randhawa et al. in 2009, 11.4% (Nachnani et al. in 2005), 5.7% (Bakos et al.,[25] 2008), 5.3% (Ishizaki et al.,[26] 2006), and 0.36% (Singh et al., 2005). This variation can be attributed to the surgeon to surgeon variations, the underlying prognostic determinants of the individual, lack of uniform evaluating system, and difference in sample size. The experience of the surgeons and time spent in perfecting the surgical techniques help in achieving a low rate of complications.

In this study, there is a positive correlation between the operative outcome and the preoperative total score of the participants (χ^2 = 74.52, df = 4, p <0.001*). There is a positive correlation between preoperative grade and operative outcome (χ^2 = 43.51, df = 1, p <0.001*). There is also a positive correlation between the preoperative score and duration of surgery (r = 0.752, p <0.001*) and the length of hospital stay (r = 0.788, p <0.001*). Finally, there is a positive correlation between the preoperative score and the intraoperative complications (χ^2 = 14.75, df = 1, p <0.001*). The validation of the scoring system is limited, owing to the small sample size. On the other hand, individual bias in surgery is avoided by following a single surgeon. An individual surgeon has been followed for the duration of our study, and the results reflect the outcomes of surgery performed by that individual surgeon. A balance has been maintained to avoid the bias from different surgeons and to get an adequate sample size.

Nine cases did not correlate with the correct prediction of outcome from scoring. Three patients with a preoperative score of 5 had difficult cholecystectomies. One of them was a 65-year-old female with a BMI of 28.50 with infraumbilical incision and impacted stone on sonologic examination. It was predicted as easy with a score of 5, but the duration extended to 70 minutes making it difficult. Another two cases were of females with a BMI of >27.5 kg/m^2 with infraumbilical incision and gallbladder wall thickness of >4 mm. They were predicted as easy with a score of 5, but the duration extended to 85 and 90 minutes, making it difficult. This is attributed to the presence of thickly adherent gallbladder in the bladder fossa.

Three patients with a preoperative score between 6 and 10 underwent easy laparoscopic cholecystectomies. One was male of 55 years of age, with a BMI between 25 and 27.5, an infra-abdominar scar (lower midline) and a wall thickness on USG abdomen and pelvis of >4 mm. The preoperative score in this patient was 6, but the operation took only 50 minutes making it easy. The other 2 males were below the age of 50, who had previous history of hospitalization for cholecystitis, one patient had GB wall >4 mm in thickness and one had a BMI of 26. The preoperative grades were 7 and 6, but both patients underwent easy cholecystectomies (55 and 50 minutes).

Three patients with a preoperative score between 6 and 10 underwent very difficult laparoscopic cholecystectomies as opposed to just difficult as predicted. Two of these patients were males above the age of 50 and with a BMI of >27.5. Both had supraumbilical scars, a GB wall thickness of >4 mm, and pericholecystic collections. Both had a preoperative score of 9 but underwent operations exceeding 120 minutes, with one patient having iatrogenic perforation of gallbladder and another having spilled gallstones. The final patient was a 60-year-old lady with previous hospitalization for cholecystitis, an infra-abdominal scar, GB wall thickness of >4 mm in size, pericholecystic collection, and an impacted stone. The preoperative score was 10, but the patient underwent a 140 minutes surgery and also had intraoperative complications of iatrogenic injury to the gallbladder.

The scoring system used in our study is extremely effective in predicting the difficulty of the LC with very high sensitivity. The ability to accurately predict and discuss the other determinants of difficulty in LC is limited by the small sample size. The focus of future research should be on finding out the exact relationship between the individual variables and the difficulty of the surgical procedure.

Summary

This study aimed to study a preoperative scoring system to predict difficult laparoscopic cholecystectomies. A prospective observational study was performed using 66 subjects. All the patients had a thorough history taken and a proper clinical examination, and all of them underwent ultrasound abdomen and pelvis scanning. Depending on history (age, sex, H/o hospitalization for attacks of cholecystitis), clinical examination (BMI, abdominal scar, and palpable gallbladder), and USG abdomen and pelvis (wall thickness, pericholecystic collection and impacted stone) parameters, all the subjects were awarded a preoperative score of 0–15. A score of 0–5 was predicted to be an easy cholecystectomy (time taken <60 minutes, no bile spillage, and no injury to duct or artery), a score of 6–10 was predicted to be a difficult cholecystectomy (time taken 60–120 minutes, bile/stone spillage, injury to duct, and no conversion), and a score of 11–15 was predicted to be a very difficult cholecystectomy (time taken >120 minutes or conversion to open).

It was seen that the scoring system evaluated in our study is a reliable, sturdy, and useful benchmark (χ^2 = 43.51, df = 1, p <0.001*) to predict difficult cases. It was excellent in predicting the intraoperative complications (85% of patients with complications had a preoperative grade of difficult), the overall difficulty of the procedure being performed, and also the duration of hospital stay.

Conclusion

This study was aimed to develop a scoring method for difficult LC and to correlate preoperative predictive factors with intraoperative difficulty in laparoscopic cholecystectomy, intraoperative complications, and duration of hospital stay, by assessing various preoperative predictors (history/clinical/imaging). The procedure of choice for management of symptomatic gallstone disease is laparoscopic cholecystectomy.

Here are the conclusions we have drawn from the study: The preoperative scoring system devised is excellent at predicting the intraoperative difficulties encountered by surgeons while performing laparoscopic cholecystectomy with a sensitivity of 88.9% and a specificity of 92.3%. The scoring system also predicted intraoperative complications with a specificity of 94.2% when the score is >7. There was also a very strong correlation between the preoperative score and the duration of surgery (r = 0.752, p <0.001) and also between the preoperative score and the duration of hospital stay (r = 0.788, p <0.001). Surgeons encounter difficulty when there were dense adhesions in the calot's triangle, fibrotic and contracted GB, acutely inflamed, and pericholecystic

collection. The risk factors which make laparoscopic surgery difficult according to our study were previous hospitalization for attacks of acute cholecystitis, obesity (especially >27.5), previous abdominal surgery, and certain ultrasonographic findings, i.e., thickened gallbladder wall, pericholecystic fluid collection, and impacted stone.

Preoperative prediction of the risk of conversion or difficulty of operation is an important aspect of planning laparoscopic surgery. Our study sample size with the outcome is strengthened in multicentric studies and larger sample size. I would conclude that the scoring system evaluated in our study is a reliable predictor of difficult cholecystectomy cases.

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