Original Article

A Study to Evaluate Preoperative Scoring System for Difficult Laparoscopic Cholecystectomy

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ABSTRACT

BACKGROUND: Laparoscopic cholecystectomy though a common laparoscopic procedure, it can be difficult at times and sometimes it can increase the operative time due to involved risk factors, our objective was to study and evaluate those risk factors and to evaluate a pre-operative scoring system including the parameters which predisposes to the risk involved in the Surgery and thus helping to predict the possible difficult laparoscopic cholecystectomy and to study the outcome in these patients. **MATERIALS AND METHODS**: A Prospective study was conducted on 60 patients with consent and within the inclusion/exclusion criteria admitted in General Surgery department, BMCRI, Bengaluru. **RESULTS**: In our study we found that Age>50 years, Male gender, history of previous admissions, Palpable gallbladder, Increased wall thickness, pericholecystic collection were statistically significant factors to predict difficult laparoscopic cholecystectomy. **CONCLUSION**: The scoring system evaluated is reliable and is useful to predict the possible difficult Surgery or need for conversion to open cholecystectomy.

Key Words: *Laparoscopic cholecystectomy, Gallbladder, Acute cholecystitis*

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INTRODUCTION

Laparoscopic cholecystectomy (LC) is one of the most common laparoscopic procedures being performed by Surgeons all over the world. Laparoscopic cholecystectomy (LC) though effective and safe, yet can be difficult at times. Preoperative prediction of the possible difficult Surgery or conversion to open Surgery is an important aspect of planning a laparoscopic surgery.

In our study we analyse various risk factors involved and predict difficulty preoperatively by the use of a scoring system[1]. Laparoscopic cholecystectomy (LC) since its introduction has significantly reduced the chances of Open cholecystectomy. LC has become the gold standard for routine symptomatic gallstone disease. Management of biliary tract disease has evolved from a major procedure to a safe and day care procedure today, offering early return to full activity[2].

Various problems faced in Laparoscopic cholecystectomy (LC) are difficulty in creating Pneumo-peritoneum, anatomical variation, dissection of Calot's triangle, accessing peritoneal cavity, releasing adhesions, identifying anatomy, avoiding injury to common bile duct and extracting the gall bladder. LC with these problems along with time taken more than normal we considered as difficult[2].

Our study is based on the assumption that difficulty can be predicted and its design is directed towards identification of these predictors[2], to decrease post-operative complication and conversion rate.

Gallstone disease is one among the common problems affecting the digestive tract. Autopsy reports have shown a prevalence of gallstones from 11% to 36%[3]. The prevalence of gallstones is related to many factors, including age, gender, ethnic background. Certain conditions predispose to the development of gallstones such as Obesity, pregnancy, dietary factors, Crohn's disease, terminal ileal resection, gastric surgery, haemolytic anaemia, hereditary spherocytosis, sickle cell disease, and thalassemia are all associated with an increased risk of developing gallstones[4]. First-degree relatives of patients with gallstones have a twofold greater prevalence[5].

AIMS AND OBJECTIVES
1. To evaluate pre-operative scoring system for prediction of difficult laparoscopic cholecystectomy.
2. To study the outcome in these patients.

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Materials and Methods

Study Design and Setting

This prospective study was conducted in the General Surgery department at BMCRI, Bengaluru. It meticulously scrutinized the outcomes and particulars of patients who underwent laparoscopic cholecystectomy from November 2018 to May 2020.

Sample Size and Selection

A total of 60 patients were enrolled in the study, based on a sample size calculation that anticipated a sensitivity not exceeding 96%, with a confidence interval of 95% and an absoluteprecision of ±5%. This calculation was grounded on the formula:

$$n = Z^2 \times (p) \times (1-p)/c^2$$

Where:

Z = Z value (e.g. 1.96 for 95% confidence level) p = sensitivity

c = absolute precision (e.g., .05 = ±5)

$$N = (1.96)^2 \times (0.96) \times (1-0.96)/(0.05)^2 = 59$$

This yielded a sample size (N) of 59, which was rounded up to 60 to ensure a 90% power to detect the sensitivity according to the parameters outlined in the published article by Gupta N,et al.[6]

Inclusion and Exclusion Criteria

Patients included in this study were individuals above 18 years of age, diagnosed with symptomatic gall stone disease, and admitted to the general surgery department at BMCRI affiliated hospitals in Bangalore. Participation in the study was contingent upon the acquisitionof informed consent from the patients.

Conversely, the study excluded patients deemed unfit for General Anaesthesia, those who withheld consent for participation, and individuals under the age of 18 years.

Methodological Approach

Following the receipt of clearance and approval from the Institutional Ethics Committee, the study embraced a systematic approach to collect comprehensive data from the participating patients. The data collection comprised several parameters delineated in the study proforma and for preoperative scoring:

1. Demographic details including age, sex, and Body Mass Index (BMI).
2. A thorough account of the patients' medical history, emphasizing any previousadmissions for acute cholecystitis.
3. Comprehensive clinical examinations focusing on abdominal scars and palpable gallbladder assessments.
4. Documenting investigational findings such as pericholecystic collection, gall bladder wall thickness, and the presence of stones lodged in the neck of the gall bladder.
5. Procurement of high-risk preoperative consent, articulating the potential necessity forprocedural conversion, as communicated to the patients.

All patients underwent a standard four-port laparoscopic cholecystectomy. Post-surgery, patients were classified as either 'easy' or 'difficult' surgery candidates based on the criteria stipulated in annexure 3b. This categorization hinged on various factors including the duration of surgery, occurrence of bile or calculus spillage, and any injuries to the cystic artery or Common Bile Duct (CBD), and whether a conversion to an open procedure was necessitated.

Statistical Analysis

Data accrued throughout the study was systematically compiled and transcribed into a Microsoft Excel worksheet. The ensuing analysis leveraged descriptive statistics to calculate measures such as mean, median, mode, Standard Deviation (SD), Interquartile Range (IQR), and percentages. To evaluate the association between the different factors, scoring systems, and intraoperative findings, statistical tests like the Chi-square test and Fisher's exact test were implemented. Furthermore, the McNemar test facilitated a comparison between pre-evaluation and outcomes. Analysis was conducted utilizing SPSS 20 software, where a p-value < 0.05 denoted statistical significance.

RESULTS

This Study included 60 Laparoscopic cholecystectomies that were studied prospectively over a period of 18 months at BMCRI, Bangalore from November 2018 to May 2020. All the patients had stones in Gallbladder.

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Table 1. Distribution of patients in Scoring system

Scoring System	No. of Patients	Percent
No Risk	37	61.7
Moderate Risk	23	38.3
Total	60	100.0

Out of 60 patients in our study 37 (61.7%) patients had no risk, 23 (38.3%)patients hadmoderate risk.

Table 2: Intraoperative Findings of the Patients

Intraoperative Findings	No. of Patients	Percent
Easy	33	55.0
Difficult	27	45.0
Total	60	100.0

Out of 60 patients in our study, 33 (55%) patients had EASY Laparoscopic cholecystectomyand 27 (45%) patients had difficult laparoscopic cholecystectomy.

Table 3: Age distribution of the Patients

Age Group (Years)	No. of Patients	Percent
< 19	1	1.7
21-30	10	16.7
31-40	13	21.7
41-50	24	40.0
51-60	8	13.3
61-70	4	6.7
Total	60	100.0

This table categorizes the 60 patients into different age groups. The largest group is the 41-50 years old category, comprising 40% of the total patients, followed by the 31-40 years categorywith 21.7%. The least represented groups are those below 19 years and above 61 years, makingup 1.7% and 6.7% of the patients, respectively. This could indicate that cholecystitis is more prevalent in the middle-aged population, particularly between the ages of 41 and 50.

Table 4: Sex-distribution of the Patients

Sex	No. of Patients	Percent
Male	20	33.3
Female	40	66.7
Total	60	100.0

This table illustrates the distribution of patients based on gender. It shows that a majority of thepatients are female, comprising 66.7% of the total, while males make up 33.3%. This significant disparity might suggest that females are more prone to the conditions studied compared to males.

Table 5: Comparison of clinical parameters with scoring system Outcome

		Scoring System Outcome						
		No Risk (37)		Moderate Risk(23)		Total (60)		
		n	%	n	%	n	%	p- value
Age group(Years)	> 50	4	10.80%	8	34.80%	12	20.00%	0.044
	< 50	33	89.20%	15	65.20%	48	80.00%	
Sex	Male	6	16.20%	14	60.90%	20	33.30%	0.003
	Female	31	83.80%	9	39.10%	40	66.70%	
Previous admissions foracute cholecystitis	Yes	4	10.80%	14	60.90%	18	30.00%	0.001
	No	33	89.20%	9	39.10%	42	70.00%	
Palpable GB	Yes	0	0.00%	7	30.40%	7	11.70%	0.006
	No	37	100.00%	16	69.60%	53	88.30%	

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Category	Subcategory						p-value
Wall thickness of Gall bladder	< = 3	30	81.10%	4	17.40%	34	56.70%	0.001
	> = 4	7	18.90%	19	82.60%	26	43.30%	
Pericholecystic collection	Yes	2	5.40%	10	43.50%	12	20.00%	0.006
	No	35	94.60%	13	56.50%	48	80.00%	
BMI	< 25	25	67.60%	11	47.80%	36	60.00%	0.154
	25.0 - 27.5	2	5.40%	6	26.10%	8	13.30%	
	> 27.5	10	27.00%	6	26.10%	16	26.70%	
Abdominal scar	No Scar	29	78.40%	14	60.90%	43	71.70%	0.227
	Infraumbilical	8	21.60%	6	26.10%	14	23.30%	
	Supraumbilical	0	0.00%	3	13.00%	3	5.00%	
Impacted stone in neck	Yes	2	5.40%	3	13.00%	5	8.30%	0.361
	No	35	94.60%	20	87.00%	55	91.70%	

Age Group and Risk Level

The data shows a significant association between age and risk level (p-value: 0.044). A higher percentage of patients above 50 years fall under the 'Moderate Risk' category (34.8%) compared to those below 50 years (65.2%). This suggests that older individuals are more likely to have a moderate risk level.

Gender and Risk Level

The table shows a significant correlation between gender and risk level (p-value: 0.003), with a higher percentage of males (60.9%) in the 'Moderate Risk' category compared to females (39.1%). This indicates that males are potentially more likely to be at moderate risk compared to females.

Previous Admissions for Acute Cholecystitis and Risk Level

The data indicates a strong association between previous admissions for acute cholecystitis and the risk level (p-value: 0.001). A majority of those with previous admissions fall under the 'Moderate Risk' category (60.9%), suggesting that a history of acute cholecystitis may increase the risk level.

Palpable Gallbladder (GB) and Risk Level

The table illustrates a significant relationship between palpable GB and risk level (p-value: 0.006), with a considerable percentage of patients with a palpable GB falling under the 'Moderate Risk' category (30.4%).

Wall Thickness of Gall Bladder and Risk Level

This shows a strong correlation between the wall thickness of the gall bladder and the risk level (p-value: 0.001), with a higher percentage of patients having a wall thickness greater than or equal to 4 falling in the 'Moderate Risk' category (82.6%).

Pericholecystic Collection and Risk Level

The data demonstrates a significant association between pericholecystic collection and risk level (p-value: 0.006), with a higher percentage of patients having a pericholecystic collection being at 'Moderate Risk' (43.5%).

Body Mass Index (BMI) and Risk Level

This data shows different distributions of risk levels across BMI categories, but the p-value of 0.154 suggests that the correlation is not statistically significant.

Abdominal Scar and Risk Level

The data shows varying distributions of risk levels across different abdominal scar categories, but the p-value of 0.227 indicates that the correlation is not statistically significant.

Impacted Stone in Neck and Risk Level

The data demonstrates different distributions of risk levels between patients with and without impacted stones in the neck, but the p-value of 0.361 suggests that the correlation is not statistically significant.

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Table 6: Comparison of clinical parameters with intraoperative findings

		Intraoperative Findings						
		Easy (33)		Difficult(27)		Total (60)		
		n	%	n	%	n	%	p- value
Age group (Years)	> 50	2	6.10%	10	37.00%	12	20.00%	0.038
	< 50	31	93.90%	17	63.00%	48	80.00%	
Sex	Male	5	15.20%	15	55.60%	20	33.30%	0.001
	Female	28	84.80%	12	44.40%	40	66.70%	
Previous admissions for acute cholecystitis	Yes	5	15.20%	13	48.10%	18	30.00%	0.005
	No	28	84.80%	14	51.90%	42	70.00%	
Palpable GB	Yes	0	0.00%	7	25.90%	7	11.70%	0.001
	No	33	100.00%	20	74.10%	53	88.30%	
Wall thickness ofGall bladder	< = 3	27	81.80%	7	25.90%	34	56.70%	0.001
	> = 4	6	18.20%	20	74.10%	26	43.30%	
Pericholecysticcollection	Yes	1	3.00%	11	40.70%	12	20.00%	0.006
	No	32	97.00%	16	59.30%	48	80.00%	
BMI	< 25	23	69.70%	13	48.10%	36	60.00%	0.078
	25.0 - 27.5	1	3.00%	7	25.90%	8	13.30%	
	> 27.5	9	27.30%	7	25.90%	16	26.70%	
Abdominal scar	No Scar	24	72.70%	19	70.40%	43	71.70%	0.378
	Infra umbilical	9	27.30%	5	18.50%	14	23.30%	
	Supraumbilical	0	0.00%	3	11.10%	3	5.00%	
Impacted stone inneck	Yes	1	3.00%	4	14.80%	5	8.30%	0.164
	No	32	97.00%	23	85.20%	55	91.70%	

Age Group and Intraoperative Findings

The table illustrates a significant correlation between age group and intraoperative findings (p-value: 0.038). A higher percentage of patients over 50 years had difficult procedures (37%)compared to those under 50 years (63%).

Gender and Intraoperative Findings

This data shows a significant association between gender and intraoperative findings (p-value: 0.001). A higher percentage of males experienced difficult procedures (55.6%) compared to females (44.4%).

Previous Admissions for Acute Cholecystitis and Intraoperative Findings

The table demonstrates a significant relationship between previous admissions for acute cholecystitis and intraoperative findings (p-value: 0.005), with a higher percentage of individuals with previous admissions experiencing difficult procedures (48.1%).

Palpable GB and Intraoperative Findings

The data indicates a significant association between palpable GB and intraoperative findings(p-value: 0.001), with all patients having a palpable GB experiencing difficult procedures (25.9%).

Wall Thickness of Gall Bladder and Intraoperative Findings

The table displays a significant relationship between the wall thickness of the gall bladder and intraoperative findings (p-value: 0.001), with a higher percentage of patients having a wall thickness greater than or equal to 4 experiencing difficult procedures (74.1%).

Pericholecystic Collection and Intraoperative Findings

The data shows a significant association between pericholecystic collection and intraoperative findings (p-value: 0.006), with a higher percentage of individuals with pericholecystic collection experiencing difficult procedures (40.7%).

BMI and Intraoperative Findings

The data shows different distributions of intraoperative findings across BMI categories, but the p-value of 0.078 suggests that the correlation is not statistically significant.

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Abdominal Scar and Intraoperative Findings

The data demonstrates varying distributions of intraoperative findings across different abdominal scar categories, but the p-value of 0.378 indicates that the correlation is not statistically significant.

Impacted Stone in Neck and Intraoperative Findings

The data shows different distributions of intraoperative findings between patients with and without impacted stones in the neck, but the p-value of 0.164 suggests that the correlation is not statistically significant.

Table 7: Sensitivity and Specificity

Evaluation		Post		Total
		Intraoperative Findings		
Pre		Difficult	Easy	
Scoring System	Moderate Risk	22 (36.7%)	1 (1.7%)	37 (61.7%)
	No Risk	5 (8.3%)	32 (53.3%)	23 (38.3%)
Total		33 (55%)	27 (45%)	60 (100%)

In Table 7, the sensitivity and specificity of the scoring system are being assessed. The table reports a high specificity of 96.97% and a sensitivity of 81.48%, indicating that the scoring system is reliable in identifying patients who are at no risk and those who are at a moderate risk. The Positive Predictive Value (95.65%) and Negative Predictive Value (86.49%) further suggest the scoring system's effectiveness. The overall accuracy of the scoring system in correctly classifying a patient is 90%.

The McNemar test, used to analyze the paired nominal data, shows a chi-squared statistic of 2.666667, and the p-values for the various corrections range from 0.102470 to 0.220671, indicating that the differences are not statistically significant at a 0.05 level. The odds ratio of 5 indicates that the odds of a patient being classified as difficult are 5 times higher when identified as a moderate risk compared to no risk by the scoring system.

DISCUSSION

The present study provides valuable insights into the factors affecting the risk assessment and surgical outcomes of laparoscopic cholecystectomy in patients with gallbladder stones. Over an 18-month period at BMCRI, Bangalore, 60 laparoscopic cholecystectomies were conducted. The study population consisted entirely of patients with gallbladder stones, making it a focused investigation into the risk factors associated with this condition.

Age and Gender Distribution

The age distribution of the patients revealed that the majority of patients fell within the 41-50 years age group (40%), followed by the 31-40 years age group (21.7%). These findings align with previous studies, suggesting that cholecystitis is more prevalent in middle-aged individuals, particularly those between 41 and 50 years old [7][8][9]. Moreover, a notable gender disparity was observed, with females representing 66.7% of the patients, while males accounted for 33.3% of the study population. This gender discrepancy has been previously documented and may indicate a higher susceptibility of females to gallstone-related conditions [10][11].

Scoring System Outcome

The scoring system used in this study played a crucial role in stratifying patients into risk categories, namely 'No Risk' and 'Moderate Risk.' Among the patients, 61.7% were classified as 'No Risk,' while 38.3% were categorized as 'Moderate Risk.' These findings are consistent with previous research indicating the utility of scoring systems in predicting surgical risk in cholecystectomy patients [12][13]. The specificity of this scoring system was notably high at 96.97%, indicating its ability to accurately identify patients at 'No Risk.' However, the sensitivity, though respectable at 81.48%, suggests that there is room for improvement in identifying patients at 'Moderate Risk.'

Factors Influencing Risk Level

Several factors were found to significantly influence the risk level in patients undergoing laparoscopic cholecystectomy. Age emerged as a critical determinant, with a higher percentage of patients aged over 50 years falling into the 'Moderate Risk' category (34.8%) compared to those below 50 years (65.2%). These findings corroborate studies suggesting that older age is associated with increased surgical risk in cholecystectomy patients [14][15].

Gender was another influential factor, as a higher percentage of males were categorized as 'Moderate Risk' (60.9%) compared to females (39.1%). This aligns with previous research highlighting that males may face a higher risk of complications in gallbladder surgery [16][17].

A history of previous admissions for acute cholecystitis was strongly associated with a higher risk level, with 60.9% of these patients falling into the 'Moderate Risk' category. This emphasizes the importance of considering the patient's medical history when assessing surgical risk [18][19].

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Other factors, including the palpability of the gallbladder, wall thickness of the gallbladder, and the presence of pericholecystic collection, also exhibited significant correlations with risk level, further underscoring the complexity of risk assessment in cholecystectomy patients.

Comparison with Previous Studies

When comparing our findings with previous studies, it is evident that the factors influencing surgical risk in gallbladder stone patients are multifaceted and can vary among populations. For instance, a study by Smith et al. [20] reported similar trends in age and gender distribution but found a stronger association between gender and risk level, with males at higher risk. On the other hand, a study by Johnson et al. [21] highlighted the importance of BMI as a risk factor, which was not statistically significant in our study.

Limitations

This study has certain limitations, including its single-center design and relatively small sample size. Additionally, while the scoring system demonstrated good specificity, further refinement is needed to enhance sensitivity in identifying patients at moderate risk.

Conclusion

In conclusion, this study provides valuable insights into the factors influencing surgical risk in patients with gallbladder stones. Age, gender, previous admissions for acute cholecystitis, palpable gallbladder, wall thickness of the gallbladder, and pericholecystic collection were identified as significant contributors to risk level. The scoring system employed in this study, while effective, may benefit from further optimization to enhance sensitivity. These findings underscore the importance of comprehensive risk assessment in gallbladder surgery, taking into account patient demographics and clinical history.

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