Research Article

Predictors of Difficult Laparoscopic Cholecystectomy and Their Outcomes in a Tertiary Care Center – A Prospective Observational Study

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ABSTRACT

Background: Cholelithiasis is the most common biliary pathology, with a prevalence of 10%-15%. It is symptomatic in approximately 1%-6 % of patients. In about 5%-10% of laparoscopic cholecystectomy, conversion to open cholecystectomy may be needed for safe removal of gall bladder. **Objective**: To evaluate the pre-operative predictors of difficult laparoscopic Cholecystectomy based on 'Risk Score for Conversion from Laparoscopic cholecystectomy to Open cholecystectomy (RSCLO) and to evaluate the outcomes of these patients. **Methods**: The source of data for the present study comprised of 100 patients admitted to Victoria Hospital and Bowring & Lady Curzon Hospital, BMCRI, Bengaluru, from January 2023 to May 2024. The cases were confirmed by USG. Following risk factors were recorded; age > 50 years, male sex, previous abdominal surgery, abdominal tenderness, USG findings which includes gall bladder wall thickening, acute cholecystitis features such as impacted stone, pericholecystic fluid collection. Each risk factor was given a score. **Statistics:** Fischer exact test was used to find the significant association of findings of preoperative score with per-operative outcome. **Result:** Out of the risk factors, USG detected gall bladder thickness, abdominal tenderness and acute cholecystitis features were significant predictors of difficult laparoscopic cholecystectomy (p value <0.005).

INTRODUCTION

Cholelithiasis is the most common biliary pathology. Gallstones are present in 10%-15% of the general population and are asymptomatic in majority of them (>80%) [1]. The prevalence of gallstones varies widely in different parts of the world. In India, it is 6.12% in the adult population[2]. Approximately 1%-2% of the asymptomatic patients will develop symptoms requiring cholecystectomy every year. Incidence gradually increases after 21 years and reaches its peak in 5th and 6th decades. Women are more affected than men in the ratio of 4:1, with the sex discrepancy narrowing in the older population to near equality [3].

Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic gallbladder stone disease. Safety, cost-effectiveness, lesser mortality and morbidity, shorter duration of hospital stay, smaller wound and minimal wound complications are the advantages. However, the rate of intraoperative conversion from Laparoscopic to Open cholecystectomy is 1%-1.5% [4,5,6]. This conversion leads to increase in perioperative time, complication rates, perioperative costs, the length of hospital stay, morbidity, hospital charges, postoperative recovery and intraoperative compli-

-cations including bile duct injury, bile leak, or bleeding, requiring reoperation or transfusion, or even death [7]. Hence it is essential to predict the risk factors for conversion preoperatively to allow for planned procedures and good surgical outcome. Assessment of the risk factors guides in determination of whether an open chole-cystectomy surgery should be planned initially, thereby avoiding the potential complications of conversion.

In a study conducted in USA in 2015 [9], factors such as age, male sex, $BMI > 30 \, kg/m^2$, preoperative alkaline phosphate levels and white cell count were evaluated for difficult laparoscopic cholecystectomy. Even though various risk factors like previous upper abdominal surgeries, obesity/BMI, ultrasound sonography (USG) findings, chole-docholithiasis and gallbladder wall thickness (mm) were individually studied in past, we sought to apply a single scoring system 'Risk Score for Conversion from Laparoscopic chole-cystectomy to Open cholecystectomy (RSCLO)' that was developed by Kama et al. in 2001 [10,11]. The various factors that were included in this study were:

- Age ≥ 60years
- Male sex

- Previous upper abdominal surgery
- Abdominal tenderness
- USG - gall bladder wall thickening

- Features of Acute cholecystitis like pericholecystic fluid collection and impacted stone

Factors	Variables	Coefficient
Age (years)	≥60	5
	< 60	0
Sex	Male	11
	Female	0
Previous upper abdominal surgery	Yes	8
	No	0
Abdominal tenderness	Present	9
	Absent	0
Gallbladder wall (USG)	Thickened	13
	Normal	0
Acute cholecystitisPresent	Present	15
	Absent	0
Constant		-20

The factors were evaluated, and scores were assigned. The RSCLO scores were graded from -20 to +40 as described by Kama et al. Patients with RSCLO scores lower than -3 were considered to be at low risk of conversion to OC, whereas those with an RSCLO score higher than -3 were considered to be at high risk of conversion. Patients underwent a regular preoperative evaluation, and laparoscopic cholecystectomy was performed accordingly. The correlation of the scores with intraoperative difficulty was then carried out .

MATERIALS AND METHODS
A. Study design: Prospective observational study
B. Study period: January 2023 to May 2024
C. Place of study: The study was conducted in the General Surgery departments in the hospitals attached to Bangalore Medical College and Research Institute, Bengaluru.
D. Sample size: 100
E. Inclusion criteria:
1. All patients admitted for elective Laparoscopic Cholecystectomy in Victoria Hospital and Bowring & Lady Curzon Hospital, BMCRI, Bengaluru.
2. Patient willing to give informed consent.
F. Exclusion:
1. Carcinoma gall bladder
2. Common bile duct stones
3. All patients who are medically unfit for laparoscopic surgery.

G. Methodology:
The OPD patients who presented with upper abdominal pain, or vomiting ordyspepsia or jaundice were examined clinically and investigated as per the standard hospital protocol. USG abdomen was done in all patients. Routine hematological and biochemical investigations were done. LFT was done in all patients. ERCP done in indicated patients. The patients confirmed by USG examination were evaluated with following factors: age, sex, history of previous hospitalization, abdominal tenderness, previous scars (supra umbilical or infra umbilical), palpable gall bladder and USG findings such as thickness of gall bladder and acute cholecystitis features (pericholecystic collection and impacted gall stones).

All the patients received symptomatic treatment pre-operatively. Following clinical evaluation, the patients were subjected to laparoscopic cholecystectomy by a single experienced surgeon. During intraoperative procedure findings like gallbladder adhesions/contracture, time taken to dissect the cystic artery and duct in Calot's triangle, biliary/stone spillage, injury to duct/ artery, conversion to open cholecystectomy and total duration of the surgery were documented. Based on the intraoperative findings, outcome was divided into simple laparoscopic chole-cystectomy (no adhesion, easy access, easy calot's triangle dissection, no spillage and no injury), difficult laparoscopic chole cystectomy (dense adhesions, difficult access, difficult calot's triangle dissection or bile/stone spillage) and open

cholecystectomy. Post operatively cases were followed up for any complication. Drain was removed between 2nd and 5th post-operative day depending on the drainage, and suture removal was done 8th post-operative day. All cases were followed up for any recurrent symptoms.

RESULTS

In the present study, the youngest patient operated was 18 years of age and the oldest was 66 years of age. Majority of the patients in the present series were in the age group of 31-40 years

Table 1: Age Distribution

Age in Year	Present Number	Percent
0-10	0	0
11-20	2	2%
21-30	24	24%
31-40	30	30%
41-50	26	26%
51-60	7	7%
>60	11	11%
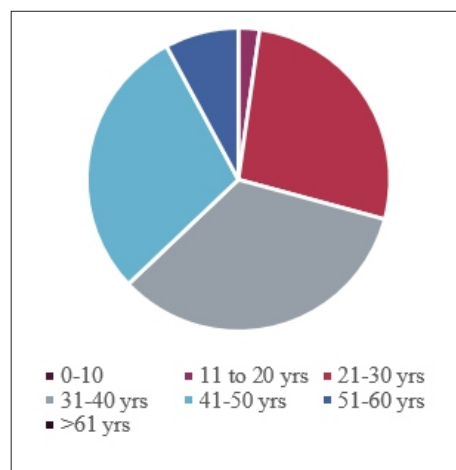
Graph 1: Age Distribution

Out of 100 patients, 70 were females and 30 were male. The male: female ratio is 1:2.3 [table 2].

Table 2: Sex Distribution

Sex	Present Number	Percent
Male	30	30%
Female	70	70%

Pain was the predominant symptom seen in all 100 patients (100%). Vomiting was present in 38 patients (38%). 2 patients (2%) had jaundice, 22 patients (22%) had dyspepsia, and 12 patients (12%) had fever. [table 3].

Table 3 : Presenting Symptoms

Symptoms	Present Number	Percent
Pain	100	100%
Vomiting	38	38%
Jaundice	2	2%
Dyspepsia	22	22%
Fever	12	12%

Mild to moderate tenderness in right hypochondrium was present in 80 patients (80%), guarding and rigidity in 4 patients (4%) and a mass was palpable in 8 patients (8%). [table 4]

Table 4: Presenting Signs

SIGNS	PRESENT NUMBER	PERCENT
TENDERNESS IN RIGHT HYPOCHONDRIUM	80	80
GUARDING	4	4
MASS	8	8

All the 100 patients had stones in gallbladder on USG. 66 patients had multiple calculi, 18 had solitary calculi and 16 had solitary impacted calculi. 38 patients had wall thickening and 16 had pericholecystic collection [table 5].

Table 5: USG Findings

USG	NO OF CASES
Multiple calculi	66(66%)
Solitary calculi	18 (18%)
Solitary impacted calculi	16 (16%)
Wall thickening	38(38%)
Pericholecystic collection	16 (16%)

The intraoperative difficulty and conversion were noted and correlated with preoperative predictors. Out of the 100 cases studied, 7 patients had conversion from laparoscopic to open cholecystectomy, and out of them, 5 patients had extensive adhesions with difficulty in dissection, 1 had uncontrolled bleeding from an anatomical variant of the cystic artery the other had mass formation. Mean duration of procedure for easy laparoscopic cholecystectomy was 42.38 mins, difficult laparoscopic cholecystectomy was 67.75 mins, and open cholecystectomy was 98.21 mins.

Pre-operative scores were calculated based on the Risk Score for Conversion from Laparoscopic cholecy-stectomy to Open cholecystectomy (RSCLO). Table 6 shows the distribution of these preoperative variables as per which scores less than -3 were 82 and those with more than -3 were 18. Correlation of scoring with the outcomes was done [table 7].

Among those with scores less than -3, 93.9% of them had an easy outcome while 6.1 % of them had a difficult outcome. Also, no case was converted to open cholecystectomy. Among the patients with preoperative score more than -3, none had an easy surgery. 61.1 % of them had a difficult laparoscopic surgery, while the rest (38.9%) were converted to open cholecystectomy. Thus, patients with RSCLO score <-3 had a higher percentage of easy laparoscopic surgery while patients with RSCLO score >-3 had higher percentage of difficult laparoscopic surgery and open surgery with p value <0.0001.

Table 6 : Pre- Operative Variables

Factors	Variables	No. of patients
Age (years)	≥60	11
	<60	89
Sex	Male	30
	Female	70
Previous upper abdominal surgery	Yes	3
	No	97
Abdominal tenderness	Present	80
	Absent	20
Gallbladder wall (USG)	Thickened	38
	Normal	62
Acute cholecystitis	Present	16
	Absent	84

Table 7 : Correlation of RSCLO Score and the Outcomes

RSCLO SCORE	EASY LC	DIFFICULT LC	OPEN	TOTAL
Less than -3	77	5	0	82
More than -3	0	11	7	18
TOTAL	77	16	7	100

P values for each of the variables and for the correlation of RSCLO scores with the outcomes were calculated. Age and Sex were found to be insignificant factors with pvalues of 1.000 and 0.6976. Hence the two factors age and sex were not predictors of difficult laparoscopic cholecystectomy in our study [table 8].

Table 8 : p-values of Verious Risk Factors

RISK FACTORS		PER-OP OUTCOME		P Value
		EASY LC	DIFF/ OPEN	
Age (years)	≥60	9	2	1.000
	<60	68	21	
Sex	male	24	6	0.7969
	female	53	17	
Previous upper abdominal surgery	yes	0	3	0.0110
	no	75	22	
Abdominal tenderness	yes	58	22	0.0375
	no	19	1	
Gallbladder wall (USG)	yes	17	21	<0.0001
	no	60	2	
Acute cholecystitis	yes	2	14	<0.0001
	no	75	9	
RSCLO score	< -3	77	5	<0.0001
	> -3	0	18	

In our study, previous upper abdominal surgeries, abdominal tenderness, palpable and thickened GB wall and acute cholecystitis with pericholecystic collection were significant predictors of difficult laparoscopic cholecystectomy with p-values <0.05. Fischer exact test was used to find the significant association of findings of preoperative score with perioperative outcome. The positive predictive value for easy prediction was 94.7% and for difficult prediction was 100%.

DISCUSSION

This study was conducted to calculate the RSCLO scoring in the study group prospectively and to evaluate its effectiveness in patient selection for laparoscopic cholecystectomy. It has shown that two factors, age and sex of the patient, are not significant predictors of difficult laparoscopic cholecystectomy. However, increased difficulty of Laparoscopic cholecystectomy has been observed with both males and older[13-21]. Previous upperabdominal surgeries cause adhesions and anatomical distortion, and hence are a risk factor for conversion of laparoscopic cholecystectomy to open cholecystectomy. [13,21]. Also, USG findings of thickened gall bladder due to chronic inflammation and fibrosis are a significant risk factor and have been proved in

previous studies[13-15].The USG features of acute chol ecystitis such as pericholecystic collection and infla mmation with accompanying clinical findings of abdominal tend erness is also a significant predictor of difficult lapa roscopic cholecystectomy in previous studies.[13-15]

A study by Goonawardena et al in 2015 showed that all the risk factors in their study, i.e. previous upper abdominal surgery, obesity/BMI, USG characteristics of Choled-ocholithiasis, Gallbladder wall thickness and impacted stone at neck of gallbladder, were significant and that out of 732 participants, 42 had a conversion to open cholecy-stectomy.[8] Most of these findings correlate with our study. In the study by Stanisic, Montrego et al in 2014, 10 parti-cipants out of 369 had a conversion to open chole-cystectomy. Also, significant risk factors were found to be previous episodes of acute Cholecystitis, thickened GB wall >4 mm, acute cholecystitis on admission, Gallstones size>2cm, recurrent pain >4 h in >5 episodes, diabetes mellitus, duration of disease>36months and pericholecystic fluid with all of them having a p-value < 0.005.

A systematic review by Alan Shiun Yew Hu et al in 2017 considered various articles that evaluated the risk factors for conversion of laparoscopic cholecystectomy[23]. In this review, a total of 30 studies involving data on 57,303 patients were included. This review endorses an association between some frequently reported risk factors such as male sex, older age, high BMI, the presence of acute cholecystitis and conversion of laparoscopic to open cholecystectomy.

The effective use of prediction models will help to plan and allocate resources more appropriately. Identifying patients with significant risk factors for conversion could minimize the adverse effects of prolonged surgery by limiting the duration of the trial of laparoscopic dissection and its consequences which include bile duct injury, bile leak, bleeding, transfusion, reoperation or even death. Four of the risk factors included in the RSCLO scoring system have been proved to be significant in our study as well as various other studies. Also, even though age and sex are not significant risk factors in our study, they have been proved to be an effective predictor of conversion to open chole-cystectomy according to many other studies, and hence need further evaluation and staunch evidence to be a justified part of the 'Risk Score for Conversion from Laparoscopic cholecystectomy to Open cholecystectomy (RSCLO).

CONCLUSION:

Age and sex of the patients are not a significant predictor. Pain is the predominant symptom seen in all (100%) the patients. Abdominal tenderness (p<0.0375) due to acute cholecystitis, acute pancreatitis, and obstructive jaundice are significant predictors of difficult laparoscopic cholecy-stectomy. Previous upper abdominal surgeries causing dense adhesions and USG findings of thickened Gall bladder and peric-holecystic collection are also significant predictors of difficult laparoscopic cholecystectomy.

LIMITATIONS:

This study has been conducted in tertiary hospital in Bangalore, and hence many complicated cases have been referred here from various peripheral hospitals, which can cause a bias in the conversion rate. The study involves a small sample size of 100 patients. A larger sample size would provide more robust data and enhance the generalizability of the findings. Also, the classification of outcomes is prone for subjective bias. Hence the scoring system needs to be validated further.

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