

Original research article

## PREDICTION OF CONVERSION OF LAPAROSCOPIC CHOLECYSTECTOMY TO OPEN CHOLECYSTECTOMY USING PREOPERATIVE SCORING SYSTEM

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**Abstract**

**Background:** Laparoscopic cholecystectomy is the gold standard procedure for symptomatic cholelithiasis. However some laparoscopic cholecystectomies need to be converted into an open cholecystectomy for various reasons. So it will be very helpful if criteria can be developed for the prediction of difficult laparoscopic cholecystectomies. The objective of this study was to evaluate pre-operative risk factors amounting to the conversion of laparoscopic cholecystectomy into an open cholecystectomy.

**Methods:** This is a prospective study in which 50 patients presenting with definitive diagnosis of cholelithiasis meeting the inclusion criteria, undergoing laparoscopic cholecystectomy were included in the study. A total of 15 score from history, clinical and sonographical findings was used for prediction of risk and score upto 5 is predicted easy, 6-10 moderate risk and above 10 is high risk.

**Results:** 51.9% of patients were less than 50 years and majority (65.1%) were females. 70.8% of patients had BMI of >25. 43.4% patients had history of previous abdominal surgeries and in 80% of patients gallbladder thickness was less than 4mm. Out of 50 patients, 9 (18%) were converted to open cholecystectomy of which 80% were under moderate risk.

**Conclusions:** Clinical and ultrasonographic factors can help to predict difficult laparoscopic cholecystectomy and likelihood of conversion of laparoscopic cholecystectomy to open surgery.

**Keywords:** Conversion, laparoscopic cholecystectomy, open cholecystectomy

**Introduction**

Laparoscopic cholecystectomy (LC) is the gold standard for treatment of symptomatic gallstones because of lower morbidity, less post-operative pain and hospital stay, better cosmesis and earlier return to regular activities <sup>[1]</sup>. One of the most common causes of abdominal pain is the presence of gallstones. Cholecystectomy is the only effective management of symptomatic gallstones. Nowadays open cholecystectomy (OC) has been widely replaced by laparoscopic cholecystectomy (LC). National Institute of Health has declared it as the treatment of choice for patients with symptomatic cholelithiasis <sup>[2]</sup>. Although it is a safer alternative to the open procedure, it is occasionally associated with intra operative difficulties which may lead to intra and post-operative complications. Intra operative factors like fatty abdomen, adhesions and frozen Callot's triangle pose a difficulty for the safe dissection. This often leads to complications such as injury to cystic artery and bile ducts, leading to bleeding, bile leak, stone spillage and biliary peritonitis intra and post operatively. In these situations, it might be appropriate to convert to open procedure to avoid significant morbidity and mortality <sup>[3]</sup>. While consenting the patients for laparoscopic cholecystectomy, it is prudent to explain them the possibility of conversion to an open procedure (OC) <sup>[4, 5]</sup>. The conversion rate as per literature ranges between 2% and 15% <sup>[6, 7]</sup>. Conversion is known to increase perioperative time, complication rates, the length of hospital stay, and hospital expenses. It is, therefore, essential to identify risk factors for conversion to allow for safer procedures and better surgical planning. The cause for conversion may be related to patient factors, surgeon factors and equipment failure. Identification of the predictive factors for conversion to open procedure is necessary to obtain a proper informed consent prior to surgery. There have been several studies that have tried to list the factors that could predict a difficult laparoscopic cholecystectomy. These include number of previous attacks of cholecystitis, WBC count, gall bladder wall thickness, pericholecystic collection, urgency, necrotic gallbladder and history of prior abdominal surgeries <sup>[8, 9]</sup>. This study was designed to identify both preoperative and intraoperative factors for conversion in patients undergoing laparoscopic cholecystectomy in a tertiary care hospital.

**Methods**

This study was conducted among 50 patients diagnosed with symptomatic cholelithiasis undergoing laparoscopic cholecystectomy at Sridevi Institute of Medical Sciences and Research Hospital (SIMSRH) Tumkur between the months of September 2021 to August 2022 to validate the scoring system developed by Randhawa and Pujari <sup>[10]</sup>.

**Inclusion criteria**

Patients above 18 years of age, patients diagnosed with symptomatic cholelithiasis undergoing elective cholecystectomy by a single surgeon were included.

**Exclusion criteria**

Patients below 18 years of age, patients undergoing cholecystectomy as a part of another procedure, patients with dilated common bile duct, choledocholithiasis and obstructive jaundice and patients not consenting for participation in the study were excluded.

The patients with clinical suspicion of gall stone disease attending OPD at SIMSRH Tumkur were subjected to abdominal ultrasonography for confirmation of diagnosis. 50 such patients with ultrasonography proven gall stone disease fulfilling the above criteria were chosen and included in the study after obtaining verbal consent. Patient details such as age, sex, BMI, previous surgical history, history of hospitalisation for biliary disease were noted. The ultrasonography findings such as wall thickness, pericholecystic collection and presence of impacted stone were also noted. Based on the above findings, the pre-operative score was calculated for each patient using the scoring system developed by Randhawa *et al.* The scoring system is given in Table 1. The maximum score was 15 and the minimum was 0. The scoring system was defined as easy if the score was less than 5, difficult if the score was between 6 to 10 and very difficult if the score was between 11 to 15. Following this the patients underwent laparoscopic cholecystectomy. To avoid discrepancy, the surgeries done by a single surgeon only were included in the study. Intra operative details such as time of surgery from first port site incision to last post closure, whether or not there was bile/stone spillage, whether or not there was arterial/duct injury and conversion to open surgery were noted.

**Table 1:** Preoperative scoring

	Parameter		Score	Max score
History	Age (in years)	<50	0	1
		>50	1	
	Sex	Female	0	1
		Male	1	
	Prior hospitalization	No	0	4
		Yes	4	
	BMI (kg/m <sup>2</sup> )	<25	0	2
25-27.5		1		
>27.5		2		
Clinical	Abdominal scar	No	0	2
		Infraumbilical	1	
		Supraumbilical	2	
	Palpable gall bladder	No	0	1
Yes		1		
Sonological	Wall thickness (in mm)	<4	0	2
		>4	2	
	Pericholecystic collection	No	0	1
		Yes	1	
	Impacted stone	No	0	1
Yes		1		
Total				15

Post operatively the surgeries were classified as easy, difficult and very difficult (as described by Randhawa and Pujari) (Table 2). Post operatively, the patients were followed up until discharge and were observed for the development of complications.

**Table 2:** Post-operative classification of the level of difficulty of surgery

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

Data collected was entered in Microsoft excel and analyzed using Epi Info software. The data was described in terms of mean and standard deviation. Student t test and chi square test was used to test the difference of significance. A p value of less than 0.05 was considered statistically significant.

**Results**

The study included 50 patients who underwent laparoscopic cholecystectomy by a single surgeon between September 2021 and August 2022. Of the 50 patients, 14 were males and 36 were females. The age of the patients included in the study ranged from 18-64 years with a maximum number of patients in the age group of 31-40 years (42%). 23 patients had age more than 50 years while the rest had age less than 50 years. 14 patients had BMI < 25, 25 patients had BMI 25-27.5 and 11 patients had BMI >27.5 kg/m<sup>2</sup>. 64% patients had history of previous surgery and 24% patients had history of hospitalisation for biliary disease. 90% patients had no palpable gall bladder prior to the surgery while it was palpable in 10% of the patients. On analysis of the ultrasonography findings it was noted that 30% of the patients had normal wall thickness while the rest had increased wall thickness; impacted stone at the neck of gall bladder was noted in 28% of the patients and pericholecystic collection was observed among 44% of the patients (Table 3). On analysis of the pre-operative risk factors and surgical outcomes, it was found that age more than 50 years, higher BMI, a history of prior hospitalisation for biliary disease, a thickened gall bladder wall, impacted stone and pericholecystic collection all had a statistically significant.

**Table 3:** Clinical and sonological characteristics of patients undergoing laparoscopic cholecystectomy

Variable	Factors	Results
Age (in years)	<50	27
	>50	23
Mean age in years	37.96±10.49	
Sex	Male	14
	Female	36
BMI (kg/m <sup>2</sup> )	<25	14
	25-27.5	25
	>27.5	11
Previous surgical history	No	18
	Infraumbilical	21
	Supraumbilical	11
Sonological findings	Multiple calculi	36
	Solitary calculus	14
	Impacted calculus	14
	Thickened GB wall	35
	Pericholecystic collection	22
Palpable gall bladder	Yes	5
	No	45
Prior hospitalization	Yes	12
	No	38

29 patients had a preoperative score of 0-5, of which 22 (75.86%) patients had easy surgery, 5 (17.24%) had difficult surgeries and 2 (6.9%) had very difficult surgeries. 18 patients had a preoperative score between 6-10, of which 5 (27.77%) had easy surgeries, 11 (61.11%) had difficult surgeries and 2 (11.11%) had very difficult surgeries. 3 patients had a preoperative score of 11-15 of which 1 (33.33%) had difficult surgeries and 2 (66.66%) had very difficult surgeries (Table 5). The sensitivity was found to be 77.8%, specificity was 78.1%, positive predictive value was 66.7% and negative predictive value was 86.2%. Intra operatively, it was found that the mean duration of surgery was 77.4±21.18 minutes. Bile and stone spillage were seen in 16 patients, 11 patients had arterial injury, and 9 patients underwent conversion to open surgery. 27 surgeries were classified as easy, 16 as difficult and 7 as very difficult.

**Table 4:** Analysis of pre-operative risk factors and surgical outcomes

Risk factors		Very difficult	Difficult	Easy	p value
Age (in years)	<50	1	6	22	0.0009
	>50	5	11	5	
Sex	Female	5	10	21	0.31
	Male	1	7	6	
Previous surgery	No	2	3	12	0.188
	Yes	4	14	15	
BMI (kg/m <sup>2</sup> )	<25	1	2	11	0.05
	25-27.5	2	12	11	
	>27.5	3	3	5	
Hospitalization	No	2	5	22	0.001
	Yes	4	12	5	
Palpable gall bladder	No	4	16	25	0.125
	Yes	2	1	2	
Wall Thickness	Normal	1	1	13	0.008
	Thickened	5	16	14	
Impacted stone	No	2	8	26	0.0001
	Yes	4	9	1	
Pericholecystic collection	No	1	6	21	0.002
	Yes	5	11	6	

**Table 5:** Correlation of pre-operative score and surgical outcome

Preoperative score	Easy	Difficult	Very difficult	Total
0 to 5	22	5	2	29
6 to 10	5	11	2	18
11 to 15	0	1	2	3
Total	27	17	6	50

## Discussion

From this prospective observational study, it was observed that the scoring system developed by Randhawa and Pujari *et al.* accurately predicted the level of difficulty of laparoscopic cholecystectomy. Further it was observed that age more than 50 years, higher BMI, a history of prior hospitalisation for biliary disease, a thickened gall bladder wall, impacted stone and pericholecystic collection all had a statistically significant accurate prediction of the difficulty in laparoscopic cholecystectomy ( $p < 0.05$ ). 05 (17.24%) of the 29 patients predicted to have an easy surgery had difficult surgeries and 2 (6.89%) had very difficult surgeries; 05 (27.77%) of the 18 patients predicted to have difficult surgery had easy surgery while 02 (11.11%) had very difficult surgeries; 1 (33.33%) of the 3 patients predicted to have very difficult surgeries had difficult surgeries.

Hussain *et al.* reported that the factors predicting difficulty in laparoscopic cholecystectomy were male sex, increased age, acute and thick wall chronic

cholecystitis, wide and short cystic duct, cholecystodigestive fistula, previous upper abdominal surgery, obesity, liver cirrhosis, anatomic variation, cholangiocarcinoma, and low surgeon's caseload. Though age wasn't a significant predictive factor for difficulty in our study, this discrepancy could be due to the small sample size in the study<sup>11</sup>. Vivek *et al.* described similar results when they reported the role of increasing age, male gender, high BMI, previous biliary disease, previous surgery, and pre-operative sonological findings in accurately predicting the intra operative difficulties of laparoscopic cholecystectomy<sup>[12]</sup>. Similar results were also obtained by Gupta *et al.*<sup>[13]</sup> and Kulkarni *et al.*<sup>[14]</sup>. The study found the scoring system developed by Randhawa and Pujari *et al.*<sup>[10]</sup> to have a sensitivity of 77.8%, specificity of 78.1%, positive predictive value of 66.7% and a negative predictive value of 86.2% in the prediction of difficult laparoscopic cholecystectomies. However, Randhawa and Pujari *et al.* reported a sensitivity and specificity of 75.00% and 90.24%, respectively. They also reported that prediction came true in 88.8% for easy and 92% difficult cases. Other studies which have tried to validate the same questionnaire have varied results. Agarwal *et al.* observed a positive predictive value of 76.4% for cases predicted to be easy and a positive predictive value of 100% for cases predicted to be difficult. Dhanke *et al.* reported a positive prediction value of 94.05% for easy prediction and 100% for difficult prediction<sup>[15, 16]</sup>. However, further studies with larger samples are needed for better validation of results.

### **Conclusion**

The difficulty of a laparoscopic cholecystectomy can be predicted pre operatively. Factors such as male sex, higher BMI, a history of previous surgery, a history of prior hospitalisation for biliary disease, a palpable gall bladder, a thickened gall bladder wall, impacted stone and pericholecystic collection are predictive factors for difficult laparoscopic cholecystectomy. The scoring system developed by Randhawa and Pujari *et al.* predicted difficult laparoscopic cholecystectomy with a sensitivity of 77.8%, specificity of 78.1%, positive predictive value of 66.7% and a negative predictive value of 86.2%. Further studies with larger samples are needed for better validation of results.

### **References**

1. Keus F, De Jong JA, Gooszen HG, Van Laarhoven CJ. Laparoscopic versus open cholecystectomy for patients with symptomatic cholecystolithiasis. *Cochrane Database Syst Rev.* 2006;4:CD00-6231.
2. Gollan J, Kalser S, Pitt H. National Institutes of Health (NIH) consensus development conference statement on gallstones and laparoscopic cholecystectomy. *Am J Surg.* 1993;165:390-6.
3. Ali A, Saeed S, Khawaja R, Samnani SS, Farid FN. Difficulties in laparoscopic cholecystectomy: Conversion versus surgeon's failure. *J Ayub Med Coll Abbottabad.* 2016;28:669-71.
4. Le VH, Smith DE, Johnson B. Conversion of laparoscopic to open cholecystectomy in the current era of laparoscopic surgery. *Am Surg.* 2012;78:1392-5.
5. Livingston EH, Rege RV. A nationwide study of conversion from laparoscopic to open cholecystectomy. *Am J Surg.* 2004;188:205-11.
6. Kama NA, Kologlu M, Doganay M, Reis E, Atli M, Dolapci M. A risk score for

- conversion from laparoscopic to open cholecystectomy. *Am J Surg.* 2001;181(6):520-5.
7. Rosen M, Brody F, Ponsky J. Predictive factors for conversion of laparoscopic cholecystectomy. *Am J Surg.* 2002;184(3):254-8
  8. Nidoni R, Udachan TV, Sasnur P, Balorkar R, Sindgikar V, Narasangi B. Predicting difficult laparoscopic cholecystectomy based on clinicoradiological assessment. *J Clin Diagn Res.* 2015;9:9-12.
  9. Ashfaq A, Ahmadi K, Shah AA, Chapital AB, Harold KL, Johnson DJ. The difficult gall bladder: Outcomes following laparoscopic cholecystectomy and the need for open conversion. *Am J Surg.* 2016;212:1261-4.
  10. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: a scoring method. *Indian J Surg.* 2009;71(4):198-201.
  11. Hussain A. Difficult laparoscopic cholecystectomy: current evidence and strategies of management. *Surg Laparosc Endosc Percutan Tech.* 2011;21(4):211-7.
  12. Vivek MA, Augustine AJ, Rao R. A comprehensive predictive scoring method for difficult laparoscopic cholecystectomy. *J Minim Access Surg.* 2014;10(2):62-7.
  13. Gupta AK, Shiwach N, Gupta S. Predicting difficult laparoscopic cholecystectomy. *Int. Surg. J.* 2018;5(3):1094-9.
  14. Kulkarni S, Kumar S, Sukumar. Preoperative predictors of a difficult laparoscopic cholecystectomy. *Int. Surg. J.* 2005;5:608.
  15. Agrawal N, Singh S, Khichy S. Preoperative prediction of difficult laparoscopic cholecystectomy: a scoring method. *Niger J Surg.* 2015;21:130-3.
  16. Dhanke PS, Ugane SP. Factors predicting difficult laparoscopic cholecystectomy: a single-institution experience. *Int. J Students Res.* 2014;4:5.