

## A Prospective Study of Various Factors that Influence the Perioperative Morbidity during Laparoscopic Cholecystectomy

Mohammed Abdul Majeeth<sup>1</sup>, Rajkumar<sup>2</sup>, Dalton Jebaraj<sup>3</sup>

<sup>1</sup>Assistant Professor, Department of General Surgery, Tirunelveli Medical College

<sup>2</sup>Associate Professor, Department of General Surgery, Tirunelveli Medical College

<sup>3</sup>Assistant Professor, Department of General Surgery, Thoothukudi Medical College

Received: 25-05-2024 / Revised: 23-06-2024 / Accepted: 26-07-2024

Corresponding Author: Dr. Mohammed Abdul Majeeth

Conflict of interest: Nil

### Abstract:

**Introduction:** Laparoscopic cholecystectomy (LC) is considered the gold standard treatment for most of the gallbladder diseases. The advantages of LC bowel function returns normal very early, reduced post-operative pain, cosmetic, shorter hospital stay and early return to full activity. At times LC has become difficult. It is very difficult to predict preoperatively, whether it is easy or difficult. The degree of difficulties in LC is again impossible to predict. At present, there is no standard scoring system to predict the degree of difficulty preoperatively. In this study, we have made out a scoring system for predicting the difficulty preoperatively and correlate with our intraoperative degree of difficulty.

**Methodology:** This study was done as a prospective observational study among patients admitted to Tirunelveli Medical College for a period of 18 months and classify them as EASY/DIFFICULT based on surgical outcome by various factors by "MAKM Vivek et al" scoring system, which includes 44 factors. Perioperative factors like age, sex, BMI, previous surgeries, altered biochemical parameters and features of USG were evaluated followed by intraoperative factors. Procedure were defined as easy or difficult as below: Easy: time taken around 60 -90 mins, no bile spillage, no injury to duct, artery. Difficult: Time taken > 90 mins, bile/stone spillage, injury to duct, conversion to open.

**Results:** In our study population of 30 patients, 11 were less than 40 years, 10 were 51-60 years, 8 were in 41-50 years rest one patient was above 60 years. 11 were male and rest 19 were female in our study. On USG, distended gall bladder was seen in 27% of patients. In our study population 19 patients, required less than 90 minutes for surgery and 11 patients required more than 90 minutes for surgery. Adhesion was seen in 33% of patients. Calculi was present in 27% of patients, bile stone/bile duct injury was seen in no patients. In our study, population in two patient's laparoscopy was converted in open. Drainage removal was done in more than 1 week in 2 (7%) of patients. Comparing with Vivek et al scoring, we had similar outcome, during our surgery too, all cases predicted as difficult by Vivek et al had difficult surgeries.

**Conclusion:** Elderly patients are more likely to have a difficult LC. Females undergo this surgery more frequently but males tend to have a higher number of difficult cases. Recurrent cholecystitis is a predictor obese patient and those with recurrent cholecystitis tend to have more difficulties during surgery. Previous surgery predisposes towards difficulties in cholecystectomy.

**Keywords:** Laparoscopic Cholecystectomy, Factor's, Difficult.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

### Introduction

Laparoscopic cholecystectomy (LC) is the standard surgical intervention for symptomatic gallstone disease and cholecystitis, heralded for its advantages over open cholecystectomy (OC), including reduced post-operative pain, shorter hospital stay, and faster recovery. [1] However, the difficulty of LC can vary significantly among patients due to various anatomical and pathological factors. This variability underscores the necessity for a reliable method to predict operative challenges preoperatively, thereby enhancing

surgical planning, patient counseling, and managing expectations regarding potential complications and operative time. [2,3]

Although more than 70% of acute cholecystitis responds to medical treatment in the first 24-48 h, laparoscopic cholecystectomy has become the method of choice in the treatment of symptomatic gallstone disease and its complications. The advantages of the laparoscopic approach include a shorter hospital stay and recovery time, reduced postoperative pain, and better cosmetic results [4-

6]. However, for various reasons there is a risk of conversion to open cholecystectomy in some patients. The most common reason for conversion is the disability to correctly identify the anatomy of Calot's triangle because of inflammation in the area around the gallbladder. It is important for the surgeon to understand that conversion to laparotomy is neither a failure nor a complication, but is an attempt to ensure patient safety. Initially, laparoscopic cholecystectomy was contraindicated in patients with acute cholecystitis because of the fear of increased morbidity and high rates (60%) of conversion to open surgery. Most of surgeons agreed that conservative treatment with antibiotics followed by interval elective operation several weeks after the acute inflammation subsides might result in a safer operation with a lower conversion rate [7]. For several years after laparoscopic cholecystectomy had been introduced, some authors continued to suggest that acute cholecystitis is a contraindication for the laparoscopic approach [8-10]. However, with experience and increased skills in laparoscopic techniques, acute cholecystitis, excluding its gangrenous form, ceased to avoid LC [11-13].

The complexity of LC is influenced by multiple patient related factors, including but not limited to, the history of previous abdominal surgeries, the patient's body mass index (BMI), the presence of acute or chronic inflammation, and specific gallbladder (GB) anatomical variations. These factors can increase the risk of complications such as bile duct injury (BDI) or the need for conversion to OC, impacting the patient's recovery trajectory and overall outcome. Based on this study was planned to assess various preoperative Factors and develop a scoring method for difficult laparoscopic cholecystectomy and to correlate preoperative predictive factors with intraoperative difficulty in lap cholecystectomy.

### Methodology

This study was done as a prospective observational study among patients admitted to Tirunelveli Medical College for a period of 18 months and classify them as EASY/DIFFICULT based on surgical outcome by various factors by "MAKM Vivek et al" scoring system, which includes 44 factors.

Those patients undergoing laparoscopic cholecystectomy will be evaluated in whom cholelithiasis confirmed by USG and age above 18 years who gave informed consent were included in the study. Whereas patients below 18 yrs of age, with raised ALP, Dilated CBD, where cbd

exploration is needed, also with features of obstructive jaundice and those refusing surgery was excluded from the study. Perioperative factors like age, sex, BMI, previous surgeries, altered biochemical parameters and features of USG were evaluated followed by intraoperative factors. Following evaluation the patient will be subjected to LC and below factors were assessed.

- Operative Time taken from incision to port closure
- Biliary / stone spillage,
- Bleeding during surgery,
- Injury to duct / artery,
- Need for conversion regarding upon the difficulty of the case

Based on above factors the patients were procedure were defined as easy or difficult as below

Easy: time taken around 60 -90 mins, no bile spillage, no injury to duct, artery

Difficult: Time taken > 90 mins, bile/stone spillage, injury to duct, conversion to open.

### Results:

In our study population of 30 patients, 11 were less than 40 years, 10 were 51-60 years, 8 were in 41-50 years rest one patient was above 60 years. 11 were male and rest 19 were female in our study.

Coming to presenting complaints, pain was present on 90% of patients, Vomiting was seen in 27% of patients, and fever was not seen in any patients. Dyspnea was present in 27% of patients.

In our study group, 13 patients had previous surgical history. Body mass index was more than 25 in 10% of patients. Abdominal scar was seen in 57% of patients. On USG, distended gall bladder was seen in 27% of patients. In our study population 19 patients, required less than 90 minutes for surgery and 11 patients required more than 90 minutes for surgery.

Adhesion was seen in 33% of patients. Calculi was present in 27% of patients, bile stone/bile duct injury was seen in no patients. In our study population in two patient's laparoscopy was converted in open. Drainage removal was done in more than 1 week in 2 (7%) of patients. Coming to post-operative complications, bile leak was present in 2 patients and serous discharge was present in two patients.

Based on Vivek et al scoring based various factors in our study population, 10 (33%) of patients had difficulty in surgery while rest 20 (67%) of cases surgery was easy.

**Table 1: Difficulty Based On Vivek Et Al Scoring**

Vivek Et Al Scoring	No Of Patients	Percentage
Easy	20	67%
Difficult	10	33%

Based on our experience in cases we did based various factors in our study population, 10 (33%) of patients had difficulty in surgery while rest 20 (67%) of cases surgery was easy.

**Table 2: Level of Difficulty**

Level of Difficulty	No of Patients	Percentage
Easy	20	67%
Difficult	10	33%

We correlated certain factors with difficulty in surgery, to start with age; there was no significant relation or influence on difficulty. Similarly, gender also did not have any significant relation.

Coming to previous surgeries among those patients who had previous surgery had an difficult laparoscopy and the relation was statistically significant with a p value of 0.037. Body mass index had no significant relation with difficulty in surgery. Similarly Distended gall bladder also no significant relation on surgical difficult. Presence of calculi makes surgery difficult with a p value of

0.035. Adhesions has a definite effect on the level of difficulty with a p value of 0.001. All difficult cases required more than 1.5 hours for surgery, which was significant difference with a p value of 0.001. Similarly, there were post-operative complications only in cases, which had difficult surgery (p-0.002).

Comparing with Vivek et al scoring, we had similar outcome, during our surgery too, all cases predicted as difficult by Vivek et al had difficult surgeries.

**Table 3: Level of Difficulty Vs Difficulty Based On Vivek Et Al Scoring**

Level of Difficulty	Vivek Et Al Scoring	
	Easy	Difficult
Easy	20	0
Difficult	0	10
Chi Square Test		
P Value - 0.001		
Significant		

Based on this we calculated the diagnostic ability of Vivek et al scoring and found that sensitivity, specificity all were 100%.

**Table 4: Diagnostic Study of Vivek Et Al Scoring**

Parameters	Easy	Difficult
Sensitivity	100.00%	100.00%
Specificity	100.00%	100.00%
Positive Predictive Value	100.00%	100.00%
Negative Predictive Value	100.00%	100.00%
Accuracy	100.00%	100.00%

## Discussion

**Difficulties Umbilical port entry:** Difficult umbilical port entry was associated pre-operatively with previous history of upper abdominal surgeries, body mass index (BMI) more than 30 and presence of upper abdominal scars/hernias. Obesity and the presence of abdominal fat causes obvious difficulty in the placement of the umbilical port as the umbilicus is displaced downwards and there is difficult to identify the umbilical fascia. Upper abdominal surgeries and presence of upper abdominal scars or hernias (indicators of previous upper abdominal surgeries) may cause formation of intra- peritoneal adhesions that may lead to increased probability of injury and bleeding while

placement of umbilical port. Shannon et al., have found that the presence of upper abdominal surgeries and presence of upper abdominal scars or hernias as being significantly associated with difficulty in umbilical port placement. Akyurek et al., [14] in their study found an association with difficult umbilical port entry and intra-operative bleeding and abnormal ductal or arterial anomalies. Our study also reflects the same.

**Gall bladder grasping:** Difficulty in gall bladder grasping was associated significantly with contracted gall bladder, distended gall bladder. A distended gall bladder or a gall bladder filled with stones is not easily grasped because it tends to slip away. Presence of inflammation around the gall

bladder makes the wall friable and oedematous, thus posing problems to grasping. Singh et al., in their study have also found significant association of gall bladder grasping difficulty with distended gall bladder and pericholecystic inflammation. Lal et al., [15] have identified that presence of large stones in the gall bladder neck leads to distention and difficulty in grasping.

**Adhesiolysis and Calot's triangle dissection:**

Preoperatively, the need of adhesiolysis was heralded by abnormal Liver function tests (LFT), elevated amylase, age >65 years, male sex, if the attack was recurrent, history of previous surgery, post endoscopic retrograde cholangiopancreatography (ERCP). Intraoperatively, non-visualisation of gall bladder, inflamed gallbladder, presence of intraperitoneal adhesions and ductal anomalies.

Calot's triangle difficulty was associated with age >65, male sex, history of previous attacks, post ERCP, abnormal LFT, elevated amylase contracted gall bladder, presence of peri-pancreatic fluid, presence of multiple stones, presence of cirrhosis on ultrasound, non-visualisation of the gall bladder, inflamed gall bladder, intra peritoneal adhesions and presence of ductal anomalies.

Increasing age is associated with an increased probability of multiple attacks of cholecystitis and also increased frequency of upper abdominal surgeries. Therefore, there is increased incidence of fibrosis and adhesions in the hepatic hilum. Randhawa et al [16] found that age more than 50 years is associated with the same difficulties. Similarly, western studies in the past have implicated age >65 years with difficulty in Calot's triangle dissection and adhesiolysis. Similarly, history of previous attacks, post ERCP status, non-visualisation of gall bladder, peri cholecystic and peri-pancreatic fluid are associated with significant inflammatory process that causes difficulty in dissection of the Calot's triangle and adhesiolysis.

Abnormal LFT and elevated amylase signify ongoing hepatitis, cholangitis and pancreatitis that pose difficulty in dissection due to oedema. Presence of an overhanging liver edge leads to obstruction in the proper visualisation of the gallbladder, thus causing difficulty in Calot's triangle dissection. Cirrhosis causes distortion of the normal anatomy of the liver and neovascularisation, thus posing problems in retraction of liver and dissection of the Calot's triangle. Palanivelu et al. [17] in their study, has also found a similar association.

**Duct and artery clipping:** Difficulty in duct clipping is significantly associated with history of upper abdomen surgery, post ERCP and presence of upper abdomen scars/hernia at preoperative evaluation. The presence of cirrhosis on ultra

sound, non-visualised gallbladder, presence of intra peritoneal adhesions, presence of ductal anomalies and arterial anomalies were predictive. Difficulty in cystic artery clipping is associated with non-visualised gallbladder, presence of ductal anomalies, presence of arterial anomalies and intra operative bleeding. Upper abdominal surgeries and cirrhosis of the liver lead to significant fibrosis and anatomical distortion in the area. In this situation, it is difficult to identify and delineate the cystic duct and artery. Thus, there is difficulty in clipping these structures. The non-visualisation of gall bladder may be due to dense pericholecystic adhesions or an intra-hepatic gall bladder. The hepatic artery and duct tend to be more difficult to identify and clip in these situations. Contemporary literatures on the same lines are not available. The presence of arterial and or ductal anomalies leads to obvious difficulty in artery clipping.

**Gall bladder extraction:** Difficulty in gallbladder extraction was associated with distended gallbladder and presence of multiple stones. A distended gallbladder or the presence of multiple stones leads to difficulty in the extraction of the specimen through the small incision thus leading to the need to aspirate the gallbladder, extend the epigastric port and the increased probability of gallbladder perforation during these maneuvers.

**Non visualisation of gallbladder:** Gallbladder not being visualised on initial introduction of scope in our study was significantly associated with difficulty in gallbladder grasping, difficulty in adhesiolysis, difficulty in Calot's triangle dissection, difficulty in duct clipping, difficulty in artery clipping, associated significantly with use of drain and use of sutures.

In our study, gallbladder not being visualised on initial introduction of scope was mostly due to dense adhesions around the gallbladder. Adhesions due to severe inflammation causes distortion of anatomy leading to difficult clipping of artery and duct and hence use of sutures.

**Advantages and Disadvantages:** In this study, more parameters were considered as compared to other. The predictive score, however, was found to be difficult to calculate because of the large number of predictors. Further, it needs to be validated prospectively in different study populations. The intra-operative predictors were the ones that have the maximum weightage, but those parameters cannot be calculated beforehand. The gold standard treatment of choice for gallbladder disease mainly symptomatic cholelithiasis is laparoscopic cholecystectomy (Oymaci et al.,) [18]. But this treatment is not devoid of complications albeit it is lower in experienced hands which require caution from the surgeon (Jethwani et al.) [19]. The present study was aimed to assess the various preoperative

predictors (history/ clinical/ imaging) and develop a scoring method for difficult laparoscopic cholecystectomy with a secondary objective of correlating preoperative predictive factors with intraoperative difficulty in lap cholecystectomy. A study of 30 patients to understand the pre-operative predictors of difficult laparoscopic cholecystectomy revealed that most of them were females (63.%, n=19). In our study, the method employed was to develop a scoring system to preoperatively ascertain the difficulty in laparoscopic cholecystectomy based on clinical findings, history and sonology. The grades were given as easy (<9), difficult (>9)

Higher BMI, adhesions, multiple calculi, previous surgeries, female gender and pericholecystic collection are associated with difficult and very difficult grading of scores. In this study, case (6%) was converted into open due to frozen calots and omental adhesions. The low rate of complications can be attained by perfecting the surgical techniques along with the experience of the surgeons.

In this study, there is a insignificant correlation between age and total score of the participants (0.778,  $p < 0.05$ ), very high significant positive correlation between operation time and total score (0.001,  $p < 0.001$ ), positive significant relationship between total score and previous abdominal surgeries (0.037,  $p < 0.001$ ), very high significant positive correlation between multiple calculus and surgical outcome (0.035,  $p < 0.001$ ), very high significant positive correlation between adhesions and surgical outcome (0.001,  $p < 0.001$ ), very high significant positive correlation between time taken up for surgery and surgical outcome (0.001,  $p < 0.001$ ), very high significant positive correlation between surgical outcome vs post-operative complication (0.002,  $p < 0.05$ ), very high significant positive correlation between surgical outcome vs difficulty based on vivek et al [19] scoring (0.002,  $p < 0.05$ )

Owing to a small sample, the validation of the scoring system is limited. The current scoring system used in this study is very effective in predicting the difficulty of the laparoscopic cholecystectomy with very high sensitivity. The smaller sample size limits the ability to accurately predict and discuss the other determinants of difficulty in laparoscopic cholecystectomy. Future research should focus on finding out the exact relationship between the individual variables and the difficulty of the surgical procedure.

### Conclusion

This study demonstrates that a scoring system predicting the difficulty in LC is feasible. There is a need for further prospective study for the validation of this score. There is scope for further refinement

to make the same less cumbersome and easier to handle. Further study shall be directed towards the same. This study was targeted at identifying the possible predictors of difficulty in LC. At the end of this study the following conclusions may be drawn. Elderly patients are more likely to have a difficult LC. Females undergo this surgery more frequently but males tend to have a higher number of difficult cases. Recurrent cholecystitis is a predictor obese patient and those with recurrent cholecystitis tend to have more difficulties during surgery. Previous surgery predisposes towards difficulties in cholecystectomy.

Patients who needed preoperative ERCP had more chances of having a difficult cholecystectomy. Abnormal serum hepatic and pancreatic enzyme profiles were associated with difficulty in surgery. Pre-operative USG can predict difficulties during LG. Features like distended or contracted gallbladder, intra-peritoneal adhesions, multiple calculi, structural anomalies or distortions and the presence of a cirrhotic liver are signs that are associated with subsequent difficulties during the surgery.

### References

1. Yol S, Kartal A, Vatansev C, Aksoy F, Toy H. Sex as a factor in conversion from laparoscopic cholecystectomy to open surgery. *JLSL*. 2006; 10:359-63.
2. Russell JC, Walsh SJ, Reed-Fourquet L, Mattie A, Lynch J. Symptomatic cholelithiasis: A Different disease in men? *Ann Surg*. 1998; 227:195-200
3. Palanivelu C, Rajan PS, Jani K, Shetty AR, Senthilkumar K, Senthilnathan P, et al. Laparoscopic cholecystectomy in cirrhotic patients: The role of subtotal cholecystectomy and its variants. *J Am Coll Surg* 2006; 203:145-51.
4. Shaffer EA. Gallstone disease: epidemiology of gallbladder stone disease. *Best Pract Res Clin Gastroenterol*. 2006; 20:981-96.
5. Schirmer BD, Winters KL, Edlich RF. Cholelithiasis and cholecystitis. *J Long Term Eff Med Implants*. 2005; 15:329-38.
6. Graves HA, Jr, Ballinger JF, Anderson WJ. Appraisal of laparoscopic cholecystectomy. *Ann Surg*. 1991;213:655-61.
7. Kum CK, Eypasch E, Lefering R, et al. Laparoscopic cholecystectomy for acute cholecystitis: is it really safe? *World J Surg*. 1996; 20:43-9.
8. Sakuramoto S, Sato S, Okuri T, et al. Pre-operative evaluation to predict technical difficulties of laparoscopic cholecystectomy on the basis of histological inflammation findings on resected gallbladder. *Am J Surg*. 2000; 179: 114-21.
9. Lal P, Agarwal PN, Malik VK, Chakravarti AL. A difficult laparoscopic cholecystectomy

- that requires conversion to open procedure can be predicted by preoperative ultrasonography. *JLS*. 2002; 6:59–63.
10. Reddick E, Olsen D, Spaw A. Safe performance of difficult laparoscopic cholecystectomies. *Am J Surg*. 1991; 161:377–81.
  11. Zucker K, Flowers J, Bailey R, et al. Laparoscopic management of acute cholecystitis. *Am J Surg*. 1993; 165:508–14.
  12. Cox M, Wilson T, Luck A, et al. Laparoscopic cholecystectomy for acute inflammation of the gallbladder. *Ann Surg*. 1993; 218:630–4.
  13. Rattner D, Ferguson C, Warshaw A. Factors associated with successful laparoscopic cholecystectomy for acute cholecystitis. *Ann Surg*. 1993; 217:233–6.
  14. Akyurek N, Salman B, Irkorucu O, Tascilar O, Yuksel O, Sare M, et al. Laparoscopic cholecystectomy in patients with previous abdominal surgery. *JLS*. 2005;9:178-83.
  15. Lal P, Agarwal PN, Malik VK, Chakravarti AL. A difficult laparoscopic cholecystectomy that requires conversion to open procedure can be predicted by preoperative ultrasonography. *JLS*. 2002; 6:59-63.
  16. Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: A scoring method. *Indian J Surg*. 2009;71:198-201.
  17. Palanivelu C, Rajan PS, Jani K, Shetty AR, Sendhilkumar K, Senthilnathan P, et al. Laparoscopic cholecystectomy in cirrhotic patients: The role of subtotal cholecystectomy and its variants. *J Am Coll Surg*. 2006; 203:145-51.
  18. Oymaci E, Ucar AD, Aydogan S, Sari E, Erkan N, Yildirim M. Evaluation of affecting factors for conversion to open cholecystectomy in acute cholecystitis. *Prz Gastroenterol* 2014; 9:336–41.
  19. Vivek, et al.: Score for predicting difficulty of cholecystectomy 66 *Journal of Minimal Access Surgery*. April-June 2014; 10(2).