

Predicting Difficult Laparoscopic Cholecystectomy Based on Clinicoradiological Assessment

Mohammad Moinul Hasan^{1*} Syed Md Muhsin² Mohammad Ershad Alam²
Shahed Mohammed Anwar³ Faisal Mostafa⁴ Mohammad Nurul Momin⁵
Matiar Rahaman Khan⁶□

ABSTRACT

Background: Laparoscopic Cholecystectomy (LC) has become the treatment of choice for symptomatic gallstone disease. But it becomes difficult to perform safely and some cases require conversion to Open Cholecystectomy (OC). There is no clear consensus among the laparoscopic surgeons to determine preoperative parameters that can predict difficult laparoscopic cholecystectomy. The aim of this study is to predict the difficult laparoscopic cholecystectomies by correlating with preoperative clinical and radiological findings.

Materials and methods: This prospective observational study was performed in the Department of Surgery at Chittagong Medical College Hospital for a period of one year from April 2018 to March 2019. The sample size was 151. Pre-operative clinical and ultrasonographic criterias were correlated with intraoperative difficulties encountered. Peroperative difficulties were considered in terms of pericholecystic adhesion, difficult callots triangle dissection, difficult GB bed dissection and unusual bleeding during surgery.

Results: Out of 151 patients underwent LC in this study; 93 (61.6%) cases the procedure was uneventful and the other 58 (38.4%) procedures were difficult. Among those difficult 58 cases, 13 (8.6%) patients required conversion to open cholecystectomy. Difficult LC were found in BMI >30kg/m², hospitalization for 3 or more times due to acute painful attack and GB wall thickness >3 mm .

Conclusion: Pre-operative prediction of difficult LC can be determined by correlating with clinical and radiological findings that help the surgeons to better prepare for intra-operative difficulties and risk of conversion to open cholecystectomy.

Key words: BMI; Callots triangle; Cholecystitis; Conversion; Difficult cholecystectomy; Pericholecystic adhesion.

Introduction

Laparoscopic Cholecystectomy (LC) considered as safe and effective surgical procedure.¹ Sometimes it may be difficult. Different preoperative clinical and sonological variables were evaluated in different studies to predict peroperative difficulties, like age, sex, BMI, history of

co-morbid diseases, number of attacks, smoking, abdominal surgery, fever during attack, jaundice, duration of attack and palpable GB etc.²⁻⁶ Pre-operative prediction of difficult LC may not only improve patient safety but also be useful in reducing the overall cost of therapy and it may be helpful for a surgeon in deciding the approach (Open/laparoscopic) or make a referral to a more experienced one as well as counselling the patient about it which one is suitable for a particular patient. Thereby it is possible to reduce morbidity, complication, rate of conversion.

Materials and methods

The protocol of this prospective observational study has been approved by the ethical committee of Chittagong Medical College Hospital. Informed consent was taken from subjects.

Patients above 18 years of age, both sexes presented with abdominal symptoms were included in the study after an abdominal Ultrasound (USG) scanning. Those confirmed as having cholelithiasis on ultrasound. Data were collected by pre-determined case record form.

All surgeries were done by competent surgeons of the Department of Surgery. The study group was subjected to laparoscopic cholecystectomy using a standard setup of Laparoscopic instrument (KARL STORZ-ENDOSKOPE. GERMANY) under general anesthesia.

1. Registrar of Surgery
Chittagong Medical College Hospital, Chattogram.
2. Assistant Professor of Surgery
Chittagong Medical College, Chattogram.
3. Registrar of Surgery
Chittagong Maa-Shishu-O-General Hospital, Chattogram.
4. Assistant Registrar of Surgical Oncology
Chittagong Medical College Hospital, Chattogram.
5. Junior Consultant of Surgery
250 Bed Chittagong General Hospital, Chattogram.
6. Professor of surgery
Chittagong Medical College, Chattogram.

*Correspondence : **Dr. Mohammad Moinul Hasan**
Cell : +88 01816 24 41 46
Email : cdccxb@gmail.com

Date of Submission : 25th November 2021
Date of Acceptance : 20th December 2021

Conversions to open cholecystectomy were carried out by upper right paramedian or Kocher's incision according to the surgeon's decision. Data were analyzed by using SPSS version 23 (IBM Corporation). Association between individual independent variables (Age group, gender, smoking behavior, BMI category, disease characteristics, and sonography findings) and dependent variable (Easy/difficult LC) was assessed by unadjusted binary logistic regression analysis. Odds ratios (ORs) with 95% confidence intervals of the ORs were estimated. $p < 0.05$ was considered statistically significant and all P-values were two sided.

Results

Table I Association of BMI with difficult and easy LC (Univariate logistic regression analysis)

BMI category	Difficult LC (n=58)	Easy LC (n=93)	Odds ratio (95% CI for OR)	p value
<25 kg/m ²	13 (27.7%)	34 (72.3%)	Reference	--
25-29.99 kg/m ²	32 (37.2%)	54 (62.8%)	1.55 (0.71-3.36)	0.267 ^{NS}
≥30 kg/m ²	13 (72.2%)	5 (27.8%)	6.8 (2.02-22.88)	0.002 ^S

BMI: Body Mass Index. Data are expressed as frequency (Percentage within BMI group).

Association with obesity and difficulty in LC is shown in Table I. It depicts that, patients with BMI ≥30 kg/m² were 6.8 times more likely to had difficult LC than the patients with BMI <25 kg/m².

Table II Association between number of hospitalization and difficult and easy LC (Univariate logistic regression analysis)

No. of hospitalization	Difficult LC (n=58)	Easy LC (n=93)	Odds ratio (95% CI for OR)	p value
One	21 (27.6%)	55 (72.4%)	Reference	--
Two	25 (45.5%)	36 (54.5%)	2.18 (1.05-4.56)	0.036 ^S
Three or more	12 (60.0%)	8 (40.0%)	3.93 (1.41-10.96)	0.009 ^S

Data are expressed as frequency (Percentage of row total). CI: Confidence Interval. OR: Odds Ratio.

Association with number of hospitalization for acute attack and the difficulty in LC is shown in Table II. The patients with a history of hospitalization for 3 or more times were 3.93 times more likely to had a difficult LC compare to the patients with history of single hospitalization.

Table III Association between GB wall thickness and difficult LC (Fisher exact test)

GB wall thickness	Difficult LC (n=58)	Easy LC (n=93)	Odds ratio (95% CI for OR)	p value
≤3 mm	39 (32.8%)	80 (67.2%)	2.99	
>3 mm	19 (59.4%)	13 (40.6%)	(1.34-6.09)	0.006 ^S

Data are expressed as frequency (Percentage within row total). CI: Confidence Interval. OR: Odds Ratio.

Table III shows that, patients with GB wall thickness >3 mm on ultrasonography were 2.99 times more likely to have difficult LC than the patients with GB wall thickness ≤3 mm.

Table IV Association of the predictive factors for difficult LC(Binary logistic regressions analysis)

Parameters	Odds ratio (95% CI of OR)	p value
Gender (Male vs. female)	1.51 (0.72-3.14)	0.275 ^{NS}
Number of hospitalization		
Two vs. single	1.89 (0.85-4.25)	0.121 ^{NS}
Three or more vs. single	2.19 (1.03-5.99)	0.038 ^S
BMI (>30kg/m ² vs. <25kg/m ²)	4.63 (1.39-15.44)	0.013 ^S
GB wall thickness (>3mm vs. ≤3mm)	3.06 (1.24-7.57)	0.015 ^S
Pericholecystic fluid collection (Yes vs. no)	2.29 (0.69-7.51)	0.171 ^{NS}
Impacted stone at GB neck (Yes vs. no)	1.57 (0.51-4.85)	0.436 ^{NS}

CI: Confidence Interval; OR: Odds Ratio.

The model suggests that BMI >30kg/m², 3 or more hospitalization for acute painful attack and GB wall thickness >3 mm are independent predictors of difficult LC (Table IV). Patients with BMI >30kg/m² are about four times (OR: 4.63; 95% CI: 1.39– 15.44) likely to undergo a difficult LC. This model also shows that patients with GB wall thickness >3mm (OR: 3.06; 95% CI: 1.24–7.51) are about three times more likely to experience difficult LC from their counterpart.

Discussion

In the present study, we have assessed the age, gender, smoking pattern, BMI, previous abdominal surgery, number of painful attack and sonographic findings (GB condition, GB wall thickness, pericholecystic fluid collection and impacted stone at GB neck) as a predictor of difficult LC among 151 patients who were undergone LC.

We found no association between age, gender, smoking behavior, history of previous abdominal surgery, GB condition, pericholecystic fluid collection and impacted stone at GB neck with intra-operative difficulty during LC in our study after multivariate logistic regression analysis. On the other hand, BMI >30kg/m², history of hospitalization for three or more painful attack and GB wall thickness >3mm on ultrasonography were found to be an independent predictive factor for difficult LC. Observations either consistent with or contradicting our results are both available in the published literature.

Simopoulos et al found that, LC is feasible and safe in patients with BMI ≥30 kg/m².⁷ BMI was not correlated with conversion and complication rates in patients who underwent a LC and the only real difference was the

longer operating time for gallbladder dissection in the obesity groups in their study. Potential technical difficulty related to obesity (Exposure of Calot's triangle, potential problems with pneumoperitoneum and abundant abdominal wall and intra-abdominal fat) are overcome by different techniques, like difficulties with abdominal fat overcome by the placing of trocar's perpendicular to the fascia or using extra-long trocars. Also, the placement of a trocar above the level of the umbilicus will decrease the distance between the laparoscope positioned via the umbilicus and the operative field.⁸

Sixteen percent patients (20/151) in present study had past history of three or more hospitalization due to episodes of acute cholecystitis. In 60% (p value=0.038) of these patients intraoperatively some difficulty was encountered. This factor was one of the most significant predictor of difficult laparoscopic cholecystectomy followed by BMI >30kg/m² and GB wall thickness >3 mm. This finding is supported by Thyagarajan et al They found a conversion rate of as high as 34% in cases with history of previous attacks of acute cholecystitis.⁹ Gupta et al also reported previous history of acute cholecystitis as a significant predictor of difficult LC.¹⁰ Acute cholecystitis may lead to increased gall bladder wall thickness and cause scarring and fibrosis in and around gall bladder, making subsequent surgery difficult. This assumption is supported by the findings. In the present series, 32 patients (21.2%) had thickened gall bladder wall (>3mm) on preoperative USG. Among them 19 (59.4%) patients had difficult LC (p=0.015). Thickened GB wall was identified as a risk factor for difficult LC in many studies and Sharma et al also concluded that GB wall which is 3 mm and thicker significantly makes more difficult dissection of GB.¹¹ Thickened GB wall at preoperative US is a sign of present inflammation or fibrosis due to cholecystitis.¹² However, contradictory observation was also reported in the literature which might be explained by the small number of patients with thickened GB wall in their study.

In present study conversion rate is comparable with most of other series reported. Dense adhesion with obscured anatomy is the most common cause of conversion.¹³ Conversion to open cholecystectomy is not a failure of technique, but is a sign of sound judgment in the interest of safety of the patient.¹⁴ In present study conversion rate is relatively low due to experience of surgeon towards laparoscopic surgery was good enough with selection of right cases.

Limitations

It was a relatively small study and the contradictory observation could be due to small number of patients as

well. Larger number of such patients could have made overall difficulty significant.

The criteria to define easy or difficulty was based on the responses obtained from various surgeons according to their experiences.

This is a single center study and the results may not be generalized.

Conclusion

Considering each factors we conclude that the difficult laparoscopic cholecystectomy and conversion to open surgery can be predicted preoperatively based on BMI, hospitalization for acute painful attack and gall bladder wall thickness by preoperative ultrasound. It is important for surgeons to apply good clinical judgment and counsel the patient accordingly if conversion is necessary or refer to a specialized center.

Recommendations

Preoperative prediction of difficult LC is important for operative planning and the high risk patients may be informed accordingly.

Further research is needed to formulate a score based assessment to predict a difficult laparoscopic cholecystectomy.

A randomized clinical trial enrolling large number of patients from multiple centers with more number of factors affecting the outcome.

Disclosure

All the authors declared no competing interest.

References

1. Jethwani, U., Singh, G., Mohil, R.S., Kandwal, V., Razdan, S., Chouhan, J et al Prediction of difficulty and conversion in laparoscopic cholecystectomy. *OA Minimally Invasive Surgery*. 2013;01:1(1):2.
2. Husain, A., Pathak, S., Firdaus, H. Assessment of Operative Predictors for Difficulty in Laproscopic Cholecystectomy. *International Journal of Contemporary Medical Research*. 2016;3(4): 1232-1234.
3. Atta, H. M., Mohamed, A. A., Sewefy, A. M., Abdel-Fatah, A.-F. S., Mohammed, M. M., Atiya, A. M. Difficult Laparoscopic Cholecystectomy and Trainees: Predictors and Results in an Academic Teaching Hospital. *Gastroenterology Research and Practice*. 2017;1-5.
4. Khandelwal, N., Salim, M., Gandhi, A. Predicting difficult Laparoscopic Cholecystectomy based on clinico radiological Parameters. *Scholars Journal of Applied Medical Science*. 5(4B):1343-1347.
5. Mudgal, M.M., Kushwah, N., Singh, R., Gehlot, H. A clinical study to determine predictive factors for difficult laparoscopic cholecystectomy. *International Journal of Medical Science and Public Health*. 2018;7(2):116-117.

6. Sharma, S.K., Thapa, P.B., Pandey, A., Kayastha, B., Poudyal, S., Uprety, K.R., Ranjit, S. Predicting difficulties during laparoscopic cholecystectomy by preoperative ultrasound. Kathmandu University Medical Journal. 2007;5(1): 8-11.
7. Simopoulos, C., Polychronidis, A., Botaitis, S., Perente, S., &Pitiakoudis, M. Laparoscopic Cholecystectomy in Obese Patients. Obesity Surgery. 2005;15(2):243–246.
8. Shashank, M., Sumit, K., Anshul, V., Rani, B., Ruchi, T., Dhanesh, K. Clinico-morphoradiological factors predicting Difficult Laparoscopic Cholecystectomy in viral marker positive and negative patients-A Hospital Based Comparative Study. IOSR Journal of Dental and Medical Sciences (IOSR-JDMS). 2017;16(10):45-59.
9. Thyagarajan, M., Singh, B., Thangasamy, A., Rajasekar, S. Risk factors influencing conversion of laparoscopic cholecystectomy to open cholecystectomy International Surgery Journal. 2017;4(10):3354-3357.
10. Gupta, N., Ranjan, G., Arora, M.P., Goswami, B., Chaudhary, P., Kapur, A et al Validation of a scoring system to predict difficult laparoscopic cholecystectomy. International Journal Surgery. 2013;11(9):1002-1006.
11. Sharma, S.K., Thapa, P.B., Pandey, A., Kayastha, B., Poudyal, S., Uprety, K.R., Ranjit, S. Predicting difficulties during laparoscopic cholecystectomy by preoperative ultrasound. Kathmandu University Medical Journal. 2007;5(1): 8-11.
12. Dhanke, P.S and Ugane, S.P. Factors predicting difficult laparoscopic cholecystectomy: A single institution experience. International journal of student's research. 2014.
13. Randhawa, J. S., and Pujahari, A. K. Preoperative prediction of difficult lap chole: a scoring method. The Indian journal of surgery. 2009;71(4):198-201.
14. Nidoni, R., Udachan, T. V., Sasnur, P., Baloorkar, R., Sindgikar, V., &Narasangi, B. Predicting Difficult Laparoscopic Cholecystectomy Based on Clinico-radiological Assessment. Journal of clinical and diagnostic research: JCDR. 2015;9(12):PC09-12.