

Original Research Article

Evaluation of preoperative predictive factors for difficult laparoscopic cholecystectomy

Ahmed S. Elgammal¹, Mohamed H. Elmeligi¹, Mostafa M. Abo Koura^{2*}

Department of Surgery, ¹Faculty of Medicine, Menoufia University, ²Tala General Hospital, Menoufia, Egypt

Received: 03 June 2019

Revised: 05 August 2019

Accepted: 06 August 2019

***Correspondence:**

Dr. Mostafa M. Abo Koura,

E-mail: logysasa@gmail.com

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ABSTRACT

Background: Laparoscopic cholecystectomy is the gold standard treatment for symptomatic cholelithiasis. However, of all Laparoscopic cholecystectomies, 1-13% requires conversion to an open surgery. Thus, for surgeons it would be helpful to establish criteria that would predict difficult laparoscopic cholecystectomy and conversion preoperatively. The objective of the study was to assess preoperative parameters for predicting the difficult laparoscopic cholecystectomy and its conversion.

Methods: Prospective study includes 100 patients having symptomatic cholelithiasis. All patients underwent elective LC in Department of General Surgery in Menoufia University Hospital and Tala General Hospital. The collected data of preoperative factors include sex, age, previous attack, history of ERCP, obstructive jaundice, obesity (BMI), lower abdominal scar, palpable gallbladder, wall thickness of, number of stones, size of stones and impacted stone. Difficulty levels according to intraoperative parameters were easy (0–5), difficult (6–10), and conversion from laparoscopic to open surgery.

Results: In this study, previous history of attacks of cholecystitis ($p=0.001$) and wall thickness ($p=0.007$) were found to be statistically significant in predicting difficult LC in both univariate and multivariate analyses. Other factors such as age ($p=0.002$), BMI greater than 27.5 ($p=0.02$), palpable GB ($p=0.003$), impacted stone ($p=0.01$) were found to be statistically significant in predicting difficult LC. Factors such as sex, and abdominal scar were not statistically significant in predicting difficult LC.

Conclusions: The difficult laparoscopic cholecystectomy and conversion to open surgery can be predicted preoperatively based on number of previous attacks of cholecystitis, WBC count, Gall bladder wall thickness and size of stones.

Keywords: Cholecystitis, Conversion, Difficult cholecystectomy

INTRODUCTION

Gallstone disease is one of the most common problems affecting the digestive tract. The prevalence of gallstones is related to factors like age, gender, and ethnic background. The prevalence of gallstone varies widely from place to place. It is estimated that approximately 20 million people in the United States have gallstones and that approximately 1 million new cases of cholelithiasis

develop each year. In Egypt the prevalence is estimated to be around 4% changing incidence in Egypt is mainly attributed to westernization of diet, change in socioeconomic structure and availability of ultrasound as investigation in both rural and urban areas.¹

The National Institute of Health (NIH) consensus development conference in the year 1992 concluded that laparoscopic cholecystectomy provides a safe and

effective treatment for most patients with symptomatic gallstones.^{2,3}

At present, laparoscopic cholecystectomy (LC) is considered the treatment of choice for symptomatic cholelithiasis. It has many advantages over open cholecystectomy in terms of minimal postoperative pain, shorter hospital stay, better cosmetics and early recovery. As the experience with LC is increasing throughout the world, selection criteria have become more liberal. Most of the factors like morbid obesity and previous upper abdominal surgery which were considered as absolute contraindication for attempting LC have no longer remained as absolute contraindications. The number of contraindications has come down significantly over time. Attempts can be made in all cases of gall stone diseases with laparoscopic procedure except for patients with bleeding diathesis, carcinoma gallbladder and patients not fit for general anaesthesia.³

However, of all laparoscopic cholecystectomies, 1-13% requires conversion to an open for various reasons.⁴ Thus, for surgeons it would be helpful to establish criteria that would assess the risk of conversion preoperatively. This would be useful for informing patients and a more experienced surgical team could be assembled when risk for conversion appears significant. Thus this study is conducted at our hospital to predict the difficult laparoscopic cholecystectomy and conversion using various clinical and radiological parameters.

METHODS

The present prospective study was conducted on 100 patients of both sex having symptomatic cholelithiasis and aged between 25 and 70 years (with exclusion of patients with acute cholecystitis, empyema of GB, CBD stones, jaundice or abnormal liver function tests, peritonitis, acute pancreatitis, cholangitis, morbid obesity, with pregnancy, portal hypertension, GB carcinoma, biliary enteric fistula, and patients who had any contraindication to laparoscopic surgery). All patients were admitted to the department of general surgery in Menoufia University Hospital and Tala General Hospital, Egypt, in the period from 1 January 2017 to 30 April 2019. All patients underwent elective LC by experienced laparoscopic surgeons. Ethical approval was taken from the concerned institutional committee for the commencement of the study. Informed written consent was taken from all patients. Data were collected by us and our residents. Diagnosis of symptomatic cholelithiasis was made based on history, clinical examination, laboratory, and radiological investigations. The preoperative predictive factors of difficult LC (preoperative scoring system by Randhawa and Pujahari) included history (age, sex, and history of hospitalization for acute cholecystitis), clinical data (BMI= weight (kg)/height (m²), abdominal scar, and palpable GB) and sonographic data (wall thickness of GB, pericholecystic collection, and impacted stone).⁹ Moreover, various

intraoperative parameters were faced while doing LC, which were used for categorization and grading of difficult level of LC as defined by Randhawa and Pujahari.⁹

The scores were compared in each patient to conclude whether preoperative predictive score was a useful method or not for prediction of intraoperative outcome. The operation was done by using CO₂ gas for pneumoperitoneum with 12 mmHg pressure. Two 10 mm and two 5 mm ports were used. The time of operation was calculated from the first port site insertion till last port site closure.

Statistical analysis

The collected data were organized, tabulated and statistically analyzed using SPSS software (Statistical Package for the Social Sciences, version 21, SPSS Inc. USA). Data were described using mean and standard deviation (SD) and frequencies according to the type of the data (quantitative or categorical respectively). Chi-square and fisher exact test were used for comparison of qualitative variables. We used one way ANOVA test to compare between means of categorical and numerical data. Significance level (p value) was adopted, i.e. p<0.05 for interpretation of results of tests of significance.

RESULTS

A total of 100 patients were included in this study; the majority of them were females [n=73 (73%)]. The patient characteristics are presented in Table 1.

Table 1: Relation of demographics characteristics of the patients and the difficulty of laparoscopic cholecystectomy.

Characteristics	Mean±SD/ Frequency	P value
Age	48.2±12.5	0.01
Sex		
Female	73 (73%)	0.03
Male	27 (27%)	
BMI	29.9±5.3	0.02
History of previous hospitalization	16 (16%)	0.003
History of abdominal surgery	14 (14%)	0.09
Palpable GB	6 (6%)	0.03

In our study, the mean age was 48.2±12.5 years (range: 25–70 years). Most patients were in the age group of 41–50 years followed by age group of 31–40. Of 100 patients, 73 were female and 27 were male patients, with female to male ratio of 3.25:1. Regarding obesity, mean BMI was 29.9±5.3.

Table 2: Relation between ultrasonographic features and difficulty of LC.

Ultrasonographic features	Mean±SD/ Frequency	P value
Thickened wall	45 (45%)	0.01
Number of stone		
Single	26 (26%)	0.07
Multiple	74 (74%)	
Size of stone	9.9±6.3	0.09
Pericholecystic collection	23 (23%)	0.03

Table 3: Relation between intraoperative parameters and difficulty of LC.

Parameters	Mean±SD/ Frequency	P value
Operative time	45.5±18.8	0.011
Intraoperative bleeding	1 (1%)	0.12
Dense adhesions	20 (20%)	0.04
Conversion to open	4 (4%)	0.035

Regarding ultrasonography findings, 74 patients had multiple stones, whereas 26 patients had solitary stone; moreover, 12 patients had impacted stone with difficult extraction, 25 patients had wall thickness greater than or equal to 4mm, and pericholecystic collection was present in 19 patients. Moreover, mean size of stone was 9.9±6.3 mm. Regarding intraoperative parameters, mean of intraoperative time 45.9±18.8 minutes.

On preoperative evaluation, the number of cases were difficult/very difficult were 16 (16%) patients, and 84 (84%) of them were easy on surgery.

Four (4%) patients were converted to open cholecystectomy from 16 (16%) patients found to be difficult/very difficult on preoperative evaluation. So in our study, there were 4 (4%) conversions, all of them were male. These conversions were owing to dense adhesions at Calot's triangle (one cases), Mirrizi's syndrome (one cases), and uncontrolled bleeding (two cases).

Regarding both univariate and multivariate analyses of preoperative outcome with risk factors, previous history of hospitalization for acute cholecystitis and wall thickness were found to be statistically significant in predicting difficult LC, whereas other factors such as age, male gender, BMI greater than 29.5, palpable GB, and impacted stone were found to be statistically significant in univariate analysis in predicting difficult LC.

Regarding both univariate and multivariate analyses of intraoperative outcome with risk factors, previous history of hospitalization and wall thickness were found to be statistically significant in predicting difficult LC, whereas other factors such as age, sex, palpable GB, and impacted

stone were found to be statistically significant in univariate analysis in predicting difficult LC.

DISCUSSION

Laparoscopic cholecystectomy, which is the treatment of choice for symptomatic gallstones, can be difficult in distorted anatomy owing to dense adhesions in Calot's triangle, empyema of GB, contracted GB, Mirrizi's syndrome, previous upper abdominal operations, and acute cholecystitis.¹⁰

Old age (age: >50 years) has been found to be a significant risk factor for difficult LC in many studies.¹¹ Age is a risk factor for difficult GB surgery.¹² In our study, we found significant correlation between age greater than 50 years and the difficult level of surgery in univariate analysis in intraoperative outcomes (p=0.01).

In studies done worldwide, male sex has been described to be associated with difficult LC.¹³ Conversion rate and significantly higher mortality have been reported in male sex.¹⁴ In the present study, there were 73 female and 27 male patients. Of 27 males, 12 patients (44.4%) of them turned out to have a difficult procedure, four (14.8%) of them were converted to open. So we found significant correlation between male sex and the difficult level of surgery in univariate analysis in intraoperative outcome (p=0.03).

The patients who require hospitalization for repeated attacks of acute cholecystitis carry more chances of difficult LC and conversion, probably owing to dense adhesions at Calot's triangle and GB fossa.¹⁴ In this study, it was found to be statistically significant for prediction of difficult LC in both univariate and multivariate analyses in intraoperative outcomes with risk factors (p=0.001; and (p=0.003, respectively).

Regarding obesity, laparoscopic surgery is difficult owing to various factors, such as port placement in obese patients takes longer time owing to the thick abdominal wall, dissection at the Calot's triangle is also technically difficult owing to the obscure anatomy because of excessive intraperitoneal fat, and there is difficulty in the manipulation of instruments through an excessively thick abdominal wall.¹⁵ In our study, BMI greater than 30 was found to be a significant factor for prediction of difficult LC only in univariate analysis in preoperative outcome with risk factors (p=0.02).

Supra and infraumbilical scar, indication of previous abdominal operations, may lead to adhesions present between viscera or omentum and abdominal wall. There may be chances of injury to these structures during insertion of first port, and the risk of conversion was reported to be higher.¹⁶ In the present study, abdominal scar was found to be statistically insignificant in both univariate and multivariate analyses of preoperative and intraoperative outcomes with risk factor.

Palpable GB was found to be predictor of difficult LC, clinically palpable GB may be due to distended GB, mucocele of GB, thick-walled or owing to adhesions between the GB and the omentum.¹⁰ In our study, six patients had palpable GB, all of them had a difficult procedure after surgery. Palpable GB was found to be statistically significant in univariate analysis of intraoperative outcomes with risk factor ($p=0.03$).

Increased thickness of GB wall is associated with difficult dissection of the GB from its bed; thick GB wall may make grasping and manipulation of GB difficult, and this also makes the dissection at Calot's triangle and the GB bed to be difficult and limits the extent of anatomical definition.¹⁷ In our study, we observed significant correlation between the GB wall thickness and the difficulty level of surgery in both univariate and multivariate analyses of preoperative and intraoperative outcomes with risk factor ($p=0.007$ and 0.02 , and $p=0.001$ and 0.02 , respectively). Pericholecystic collection was found to be a predictor of difficult LC.¹⁸ Other studies found that pericholecystic collection was found to be insignificant factor in the difficulty level of LC.⁹ In our study, we found no significant correlation between pericholecystic collection and the difficulty level of surgery in both univariate and multivariate analyses of preoperative and intraoperative outcomes.

Impacted stone at the neck of GB poses some technical problems in LC, because of distension of GB, with thick GB wall. It is difficult to grasp the GB neck to allow adequate retraction to perform dissection at Calot's triangle.⁸ In this study, impacted stone at the neck of GB was found to be statistically significant in univariate analysis of preoperative and intraoperative outcomes with risk factor ($p=0.01$ and 0.003 , respectively).

Conversion rate reported in literature was between 7 and 35%.¹⁹ Other researchers reported that, difficult cases are associated with a conversion rate of 25% [20]. In our study, the conversion rate was 4%, because of dense adhesions at Calot's triangle (one case=1%), Mirrizi's syndrome (one case=1%), and uncontrolled bleeding (two cases=2%). Overall, all of them were male.

CONCLUSION

Previous history of hospitalization for acute cholecystitis and wall thickness of GB (in both univariate and multivariate analysis), along with age, sex, BMI greater than 30, palpable GB, and impacted stone (in univariate analysis) were found to be statistically significant to predict difficult LC. However, there was no significant correlation between abdominal scar and pericholecystic collection with the difficulty level of surgery. We concluded that the preoperative scoring system is statistically and clinically a good test for predicting the operative outcome in LC.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Ethical approval was granted for the study by Menoufia University-Faculty of Medicine's ethics committee according to the Declaration of Helsinki. It was taken for research done on patients diagnosed with cholecystitis

REFERENCES

- Shaffer EA. Gallstone disease: epidemiology of gallbladder stone disease. *Best Pract Res Clin Gastroenterol.* 2006;20:981–96.
- Rao KS, Meghavathu GN, Rao GS, Prasad HRT. Clinical study of gallstone disease and treatment options. *J Evol Med Dent Sci.* 2015;4:13841–8.
- Thamil RS, Sinha P, Subramaniam PM, Konapur PG, Prabha CV. A clinicopathological study of cholecystitis with special reference to analysis of cholelithiasis. *Int J Basic Med Sci.* 2011;2:68–72.
- Le VH, Smith DE, Johnson BL. Conversion of laparoscopic to open cholecystectomy in the current era of laparoscopic surgery. *Am Surg.* 2012;78:1392–5.
- Singh K, Ohri A. Difficult laparoscopic cholecystectomy: a large series from north India. *Indian J Surg.* 2006;68:205–8.
- Abdel Baki NA, Motawei MA, Soliman KE, Farouk AM. Pre-operative prediction Of difficult laparoscopic cholecystectomy using clinical and ultrasonographic parameters. *JMRI.* 2006;27:102–7.
- Lee NW, Collins J, Britt R, Britt LD. Evaluation of preoperative risk factors for converting laparoscopic to open cholecystectomy. *Am Surg.* 2012;78:831–3.
- 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.
- Randhawa JS, Pujahari AK. Preoperative prediction of difficult lap chole: a scoring method. *Indian J Surg.* 2009;71:198–201.
- Chen RC, Liu MH, Tu HY, Chen WT, Wang CS, Chiang LC, et al. The value of ultrasound measurement of gallbladder wall thickness in predicting laparoscopic operability prior to cholecystectomy. *Clin Radiol.* 1995;50:570–2.
- Sahu SK, Agrawal A, Sachan PK. Intra-operative difficulties in laparoscopic cholecystectomy. *J de Chirurgie (Iasi).* 2013;2:149–55.
- Simopoulos C, Botaitis S, Polychronidis A, Tripsianis G, Karayiannakis AJ. Risk factors for conversion of laparoscopic cholecystectomy to open cholecystectomy. *Surg Endosc.* 2005;19:905–9.
- O'Leary DP, Myers E, Waldron D, Coffey JC. Beware the contracted gallbladder— ultrasonic predictor of conversion. *Surgeon.* 2013;11:187–90.
- Bouarta L, Schneider A, Feussner H, Navab N, Lemake HU, Jonker PP, et al. Prediction of intraoperative complexity from preoperative patient

- data for laparoscopic cholecystectomy. *ArtifIntell Med.* 2011;52:169–76.
15. Rosen M, Brody F, Ponsky J. Predictive factors for conversion of laparoscopic cholecystectomy. *Am J Surg.* 2002;184:254–8.
 16. Hussain A. Difficult laparoscopic cholecystectomy: current evidence and strategies of management. *Surg Laparosc Endosc Percutan Tech.* 2011;21:211–7.
 17. Fried GM, BarkunJS, Sigman HH, Joseph I, Clas D, Garzon J, et al. Factors determining conversion to laparotomy in patients undergoing laparoscopic cholecystectomy. *Am J Surg.* 1994;167:35–9.
 18. Dhanke PS, Vgane SP. Factors predicting difficult lap laparoscopic cholecystectomy: a single institution experience. *Int J Stud Res.* 2014;4:3–7.
 19. Khan IA, El-Tinay OE. Laparoscopic cholecystectomy for acute cholecystitis: can preoperative factors predict conversion? *Saudi Med J.* 2004;25:299–302.
 20. Szabo K, Rothe A, Shamiych A. Laparoscopic cholecystectomy – review over 20 years with attention on acute cholecystitis and conversion. *Eur Surg.* 2012;44:28–32.

Cite this article as: Elgammal AS, Elmeligi MH, Koura MMA. Evaluation of preoperative predictive factors for difficult laparoscopic cholecystectomy. *Int Surg J* 2019;6:3052-6.