

Assessment of risk factors for difficult surgery in laparoscopic cholecystectomy

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Abstract

Background: Laparoscopic cholecystectomy (LC) may be rendered difficult by various problems encountered during surgery. Prediction of a difficult LC would allow the surgeon to discuss the likelihood of conversion with the patient and prepare the patient psychologically as well as planning their recovery and explaining their absence from work. This study aim to assess the preoperative factors for prediction of difficulty of LC and the possibility of conversion to open cholecystectomy before surgery using the clinical, pathological and ultrasonological criteria. **Material and Methods:** This study was carried out on 60 patients with symptomatic cholelithiasis, normal liver function tests and non-dilated bile ducts scheduled for LC. Age, sex, body mass index, previous abdominal surgery and past history of acute attack of cholecystitis of the patients were recorded. Apre-operative ultrasound was performed along with routine blood investigations. **Results:** Overall conversion rate was 3.3%. Univariate analysis showed that sex, fever at the time of attack, gall bladder wall thickness, pericholecystic collection on ultrasonography, raised liver function test and total leucocyte count were significant for conversion. **Discussion:** It is possible to predict the risk of conversion and patients can be informed preoperatively. Patients with a high preoperative factors for prediction of difficult LC may allow the surgeon to take an early decision to convert to OC when difficulty is encountered during dissection; this may shorten the duration of surgery and decrease the associated morbidity.


Key Words: Laparoscopic cholecystectomy, conversion, risk factors, ultrasonography.

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INTRODUCTION

Laparoscopic cholecystectomy (LC), since its advent in 1985 has dramatically replaced open cholecystectomy in the management of symptomatic cholelithiasis¹. It decreases post-operative pain, ileus, allows earlier oral intake, shortens hospitalization and improves cosmetic results². Laparoscopic cholecystectomy may be rendered difficult by various problems encountered during surgery such as difficulties in accessing the peritoneal cavity, creating a pneumoperitoneum, dissecting the gall bladder

or extracting the excised gallbladder³. Several studies have been published in the past years trying to assess risk factors for difficult laparoscopic cholecystectomy. Based on previous study, we may consider patient related preoperative factors which may predict difficult laparoscopic cholecystectomy, such as, elderly age, male gender, nutritional status, overweight or obesity, history of acute cholecystitis and previous abdominal surgery. Few investigation related factors which may predict difficult laparoscopic cholecystectomy are abnormalities of liver function test (LFT), total leucocyte count (TLC), thickened gall bladder wall, impacted stone, pericholecystic collection, stone size and number, abnormality of anatomy and liver fibrosis^{4,5}. In spite of increasing expertise and advances in technology conversion rate is still 1.5-19% in different setups⁴. It is important to realize that the need for conversion to laparotomy is neither a failure nor a complication but an attempt to avoid complication and ensure patient safety. Prediction of a difficult LC would allow the surgeon to discuss the likelihood of conversion with the patient and prepare him/her psychologically as well as planning their

recovery and explaining their absence from work. Another benefit would be to allow more efficient scheduling of the operating lists and ensuring the availability of a more experienced laparoscopic surgeon for the procedure. This study would further established preoperative factors for prediction of difficulty of LC and the possibility of conversion to open cholecystectomy (OC) before surgery using the clinical, pathological and ultrasonological criteria.

MATERIAL AND METHODS

In this prospective observational study 60 cases undergoing laparoscopic cholecystectomy were studied of preoperative factors for prediction of difficult laparoscopic cholecystectomy. After ethical approval from institutional ethical committee, this study was carried out on 60 patients with symptomatic cholelithiasis, normal liver function tests and non-dilated bile ducts that were admitted to the general surgery ward of tertiary care hospital and chosen for laparoscopic cholecystectomy. All consecutive eligible patients within a period from October 2014 to April 2016 were included. Patients with acute cholecystitis, mucocele and pyocele and evidence of concomitant choledocholithiasis. Cases with laparoscopic cholecystectomy with common bile duct (CBD) exploration, laparoscopic cholecystectomy performed with other laparoscopic intervention in same setting and absolute contraindication to laparoscopic cholecystectomy like cardiovascular, pulmonary disease, coagulopathies and end stage liver disease were excluded from the study. Every patient included in the study was subjected to the following assessments which were regarded as preoperative factors for prediction of difficult laparoscopic cholecystectomy.

Pre-operative (independent) variables: This included patients characteristics, such as, gender, age, weight, height and body mass index were used as continuous variables. Patients that had BMI of 30 or more were considered obese and BMI of 25 or more consider overweight according to the WHO definition.

Clinical Examination: History of jaundice and symptoms of pain, dyspepsia and vomiting were also considered. Acute cholecystitis was defined as right upper quadrant pain of acute onset, lasting more than 3 hours, in the presence of fever or leucocytosis, associated with cholelithiasis, thick gall bladder wall more than 3 mm, evidence of peri-cholecystic fluid collection, and requiring emergency admission. Previous abdominal surgery was categorized as non versus any intra-abdominal surgery. The clinical signs of cholecystitis considered were tender right hypochondrium, positive Murphy's sign and palpable gall bladder.

Laboratory data: Complete blood picture, bleeding and coagulation times, fasting blood sugar, serum urea and creatinine, liver transaminases, prothrombin time and activity, serum bilirubin and alkaline phosphatase.

Abdominal ultrasound parameters: Gallbladder wall thickness was estimated by using the maximal obtainable measurement and evaluated as a dichotomous variable (thick ≥ 3 mm versus normal <3 mm). The calculus size was evaluated as a dichotomous variable for the purpose of analysis (small < 1 cm versus large ≥ 1 cm). The number of calculi was classified as a dichotomous variable (solitary versus multiple). Any impacted stone at neck of gallbladder, peri-cholecystic collection.

The dependent variables (outcomes): All cases underwent LC with assessment of the difficulties encountered in terms of: 1. duration of surgery (in minutes): Duration of surgery included the time from port site incision to closure of wound and was evaluated as a continuous variable. 2. Bleeding during surgery: Bleeding during surgery was graded as minimal, moderate or severe. Moderate bleeding was defined as bleeding leading to tachycardia of greater than 100/minute without drop in blood pressure. Severe bleeding was defined as bleeding leading to tachycardia of greater than 100/minute with a greater than 10mm Hg drop in blood pressure. 3. Access to peritoneal cavity: The operating surgeon described the access to peritoneal cavity as "easy" or "difficult". 4. Gall bladder bed dissection: The operating surgeon described GB bed dissection as "easy" or "difficult". 5. Difficult extraction: Extension of incision for extraction. The operating surgeon described GB extraction as "easy" or "difficult". 6. Conversion to open cholecystectomy (OC). All patients were followed up in outpatient department for 2 months and findings noted in terms of pain, suture line and scar status. Complications if any were identified and recorded.

RESULTS

A total of 60 patients with symptomatic gallbladder disease who had undergone laparoscopic cholecystectomy were included in study. Out of 60 subjects included, 16(26.6%) were male and 44 (73.3%) were female. Maximum 37 subjects were from age group ≤ 40 years including 6 (10%) male and 31 (51.6%) female subjects. Age group 41-50 years included 5 (8.3%) male and 6 (10%) female while age group 61-70 year included 2 (3.3%) male and 3 (5%) female subjects. Out of 60 LC, 58 successfully undergone laparoscopic cholecystectomy but 2 cases were converted to open which were very difficult to dissect and bleed severely. Of 60 patients, 24 were difficult LC. Out of 24 difficult LC, 21 cases were ≤ 60 years and 3 cases were > 60 years old. So, elderly age group (> 60 yrs) were not found to be statistically

significant preoperative factor for difficult LC (p=0.34). Out of 24 difficult cases, 10 were male and 14 were female. Thus as a preoperative factor male sex were found to be statistically significant (p=0.03). In this study, patients with symptomatic cholelithiasis, pain was most common symptom present in all 100% cases, followed by vomiting 16.6% and fever only in 10% patients. Out of 60 patients, 16 patients had history of previous surgery, 9 patients had history of similar episodes and 7 patients had co-morbidity. Out of 24 difficult LC, 4 had history of vomiting. So, as a preoperative factors vomiting was not found to be statistically significant (p= 0.6) for prediction of difficult LC. Out of 60 patients, 6 patients had fever among them 5 patients undergone LC were difficult. Thus, as a preoperative factors fever was found to be statistically significant factors for prediction of difficult LC(p=0.03). History of previous abdominal surgery (p=0.12), and co-morbidity (p=0.13) were not found to be statistically significant to be label as preoperative factors for prediction of difficult LC. The patients who had duration of illness more than 30 days were consider as chronic cholecystitis (CC) and patients who had similar episode in past were consider as recurrent cholecystitis (RC). Most of the patients (44 patients) were diagnosed as acute calculus cholecystitis (ACC). Other 7 patients were diagnosed as chronic cholecystitis and 9 patients were diagnosed as recurrent cholecystitis. Out of 24 difficult cases, 18 were acute calculus cholecystitis, 3 were chronic cholecystitis and 3 were recurrent cholecystitis. So, there were no statistical significance (p=0.9) found to be associated with these preoperative factors. Most of the patients had BMI in the range of 18.5-25 in this study. In this study, most of the patients, 38 (63.3%) had BMI 18.5-25; 18 patients (30%) had BMI between 25.1-30. BMI with more than and equal to 30 were consider as obese while 25 or more consider as overweight. Out of 24 difficult cases, 16 had BMI <25, whereas, 8 had BMI ≥25. So, overweight was not found to be associated with difficult laparoscopic cholecystectomy (p=0.5). Of the 60 patients, 6 patients

has raised LFT and 54 patients had normal LFT. Five patients with raised LFT, had difficult LC. Thus, raised LFT was found to be statistically significant for prediction of difficult LC (p=0.03). Out of 60 patients, 5 patients had leukocytosis (TLC ≥11000) and all were associated with difficult LC. While 55 patients had TLC <11000, of which only 19 were associated with difficult LC. So, TLC ≥11000 were found to be statistically significant for prediction of difficult LC (p=0.007). In this study, only 4 (6.6%) patients had impacted stone; 7 (11.6%) patients had peri-cholecystic collection. These 4 patients with impacted stone were associated with difficult LC. As a preoperative factors, impacted stone was found to be statistically significant for prediction of difficult LC (p=0.02). Out of 7 patients had pericholecystic collection of which 6 were undergone difficult LC. So, pericholecystic collection was found to be associated significantly with difficult LC (p=0.01). In this study, 47(78.3%) patients had multiple small calculi and 13 (21.6%) patients had single large calculi. Out of 24 difficult cases, 4 patient had single large calculi and 20 had multiple small calculi. So, number and size of calculi were not found to be statistically significant for prediction of difficult LC (p=0.33). In this study, most of patients, 44 patients (73.3%) had GB wall thickness ≤3 mm and only 16 patients (26.6%) had GB wall thickness >3 mm. Out of 24 difficult LC, 13 patients had GB wall thickness > 3mm. So, GB wall thickness >3 mm were found to be statistically significant for prediction of difficult LC (p=0.0002). Average duration of surgery in our study was 96.67 minutes. LC which were taken duration more than 90 minutes were consider difficult in the study. In this study 24 (40%) cases were difficult LC. Other difficulties were difficulty to dissect Callot's triangle and gallbladder in 15 patients, bleeding more than 50 ml during dissection in 5 patients and bile leak in 3 patients.

The Average post-operative stay in this study was 5.16 days. In this study 46 (76.6%) cases were discharged within 5 days.

Table 1: Comparison of various preoperative factors in difficult laparoscopic cholecystectomy

Pre-operative Factors		Difficult laparoscopic cholecystectomy		p Value
		Yes (n=24)	No (n=36)	
Age (Years)	≤60	21	34	0.34
	<60	3	2	
Sex	M	10	6	0.03
	F	14	30	
Vomiting	P	4	6	0.6
	A	20	30	
Fever	P	5	1	0.03
	A	19	35	
Duration of illness (days) (Mean ±S.D.)		28.6 ± 4.9	28.38±5.3	0.4
Diagnosis	ACC	18	26	0.9
	CC	3	4	

	RC	3	6	
BMI	≤25	16	25	0.5
	>25	8	11	
Previous abdominal surgery	Y	4	12	0.12
	N	20	24	
LFT	Raised	5	1	0.03
	WNL	19	35	
TLC Count	<1100	19	36	0.007
	≥1100	5	0	
GB wall thickness (cm)	≤3	11	33	0.0002
	>3	13	3	
Impacted stone	Y	4	0	0.02
	N	20	36	
GB calculi	Single	4	9	0.33
	Multiple	20	26	
Pericholecystic collection	Y	6	1	0.01
	N	18	35	
Co-morbidity	Y	1	6	0.13
	N	23	29	

Age was found to be higher in subjects with difficult laparoscopic cholecystectomy. Compared to non-difficult laparoscopy group, but the difference failed to reach statistical significance (p=0.34). Frequency of male gender was found to be higher on subjects with difficult laparoscopic cholecystectomy (p=0.03). Significant higher frequency of fever (p=0.03), raised LFT (p=0.03), raised TLC (p=0.007), GB Wall thickness >3 cm (p=0.0002), Impacted stone (p=0.02), and pericholecystic collection (p=0.01) was noted in subject with difficult laparoscopic cholecystectomy. No significant association was detected between Difficult LC and some preoperative factors like Age, history of vomiting, duration of illness, diagnosis, BMI, history of previous abdominal surgery and co-morbidity (Table 1).

DISCUSSION

Several studies have been published in the past years trying to assess preoperative factors for difficult laparoscopic cholecystectomy. This study is a further continuation of these studies to assess clinical, hematological and ultrasonological factors which can predict difficult laparoscopic cholecystectomy. Age is recognized as a factors for prediction of difficult LC in most of the studies^{4,6,7}. In this study, age was found to be higher in subjects with difficult laparoscopic cholecystectomy compared to non-difficult laparoscopy group, but the difference failed to reach statistical significance (p=0.34). The present study and some other authors did not notice age to be associated with conversion rate^{8,9}. Frequency of male gender was found to be higher on subjects with difficult laparoscopic

cholecystectomy (p=0.03). Study of Kama *et al*⁴, Hutchinson *et al*⁸, Teixeira J *et al*⁹ and Zisman *et al*¹⁰ also showed that male gender is a risk factor for severe symptomatic cholelithiasis. Hutchinson *et al*⁸ reported two-time increase in conversion rate when BMI is >27.2 kg/m, but Simopoulos *et al*¹¹ and Unger *et al*¹² found that LC is effective and safe in patients with morbid obesity. The current study also showed similar result that BMI ≥25 (overweight) not associated significantly with difficult LC (p=0.5). In this study some clinical factors were found to be statistically significant like fever (p=0.03) but vomiting (p=0.6), co-morbidity (p=0.13) and previous history of abdominal surgery (p=0.12) was not found to be statistically significant. Fever has been identified as a risk factor for conversion in our study and by many workers in their studies^{13,14}. In a study done by Ibrahim *et al*¹⁵ and Nachnani *et al*¹⁶ previous abdominal surgery is a factor that predict difficult laparoscopic cholecystectomy and conversion to open cholecystectomy. Raised TLC has been identified as a risk factor for predicting conversion in many previous studies^{4,13,14}. In our study, there was significantly more risk of conversion in patients having TLC >11000/cmm. Patients with raised counts in cases of acute cholecystitis are likely to have a complicated gall bladder and persistent inflammation and edema makes the surgery difficult. Raised LFT was also found to be statistically significant for prediction of difficult LC (p=0.03). Alponat *et al*² showed local signs of cholecystitis to be significant predictors for conversion to open cholecystectomy (OC). Kama *et al*⁴, Hutchinson *et al*⁸ and Nachani *et al*¹⁶ considered GB wall thickness to be the

most important sonographic risk factor of conversion to OC. In almost all of the studies, gall bladder wall thickness has been identified as a risk factor for conversion. Though, critical thickness of gall bladder associated with conversion varies from 3 mm to 6 mm in different studies¹⁶⁻¹⁸. In present study, it was 3 mm. Most of the studies did not find any statistical significance with number of stones and risk of conversion^{8,17}. We also observed the same. Conversion to open cholecystectomy in our study was resorted to in 2 patients (3.3%) undergoing LC. The need for conversion was due to severe bleeding during dissection and difficulty to dissect. This is consistent with the previous studies where the conversion rates observed was 3 to 5%¹⁹. Patients with a high preoperative factors for prediction of difficult LC could be operated on either by or under the supervision of a more experienced surgeon. Also, a high preoperative factors for prediction of difficult LC may allow the surgeon to take an early decision to convert to OC when difficulty is encountered during dissection; this may shorten the duration of surgery and decrease the associated morbidity.

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