

Prediction of difficulty and conversion in laparoscopic cholecystectomy

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Abstract

Introduction

Laparoscopic cholecystectomy is now considered the gold standard for the treatment of symptomatic cholelithiasis. The difficult gallbladder is the most common 'difficult' laparoscopic surgery being performed by general surgeons all over the world and the potential one that places the patient at significant risk. Although the rate of conversion to open surgery and the complication rate are low in experienced hands, the surgeon should keep a low threshold for conversion to open surgery and it should be taken as a step in the interest of the patient rather than be looked upon as an insult to the surgeon. Various preoperative factors can help in deciding the difficult gallbladder and conversion to open cholecystectomy. The aim of this study is to predict the difficulty of laparoscopic cholecystectomy and the possibility of conversion to open cholecystectomy before surgery using the clinical and ultrasonographic criteria in our set up.

Materials and methods

A total of 200 patients presenting with symptomatic gall stone disease between January 2011 and June 2012 were included in the study. Every patient included in the study was subjected to the following assessments which were regarded as risk factors for laparoscopic cholecystectomy: patients' characteristics, complaints, history and clinical examination and laboratory data.

Results

Amongst the 200 patients admitted for laparoscopic cholecystectomy, 47 (23.5%) were male and 153 (76.5%) female, with an average age of 39 years (range 16–62 years). The body mass index ranged from 16.3 to 42.7 with a mean of 32.8 ± 6.28 kg/m². Five patients were considered obese (BMI > 35 kg/m²).

Conclusion

Male gender, single large stone, thick-walled gallbladder, previous abdominal surgery and contracted gallbladder are the factors that proved to be significant factors in our study.

Introduction

Laparoscopic cholecystectomy (LC) has gradually replaced open cholecystectomy (OC) in the treatment of symptomatic gall stone disease. Better cosmetic results, short hospital stay, early recovery and return to physical activity and work have all contributed to the popularity of this technique, establishing it as the gold standard for the treatment of cholelithiasis¹⁻³. In the beginning, patients with acute cholecystitis, empyema, gangrenous gallbladder, cirrhotic patients and Mirizzi syndrome were contraindication for carrying out LC because of high risk of complications and conversion rate⁴.

With the increase in expertise and introduction of newer armamentarium, difficult gallbladders are being subsequently dealt with. However, before dealing with the difficult gallbladders, the skill of the surgeon, experience in laparoscopic techniques and thorough knowledge of risk factors are collectively important for a safe outcome. Even in the present era, the laparoscopic surgeon, amidst such a substantial advance in lapa-

roscopy, should have low threshold for conversion to open technique in case of difficulty. Conversion rates of 1.5%–19% have been reported in different published series⁵. The difficult gallbladder is the most common 'difficult' laparoscopic surgery being performed by general surgeons around the world and the potential one that places the patient at significant risk. It is important to know the different clinical, radiological parameter and specific predictor that give some prediction of difficult LC, which not only helps in patient counselling but also helps the surgeon to prepare better for intraoperative difficulties expected to be encountered. Laparoscopic cholecystectomy is associated with less morbidity than OC if carried out successfully, irrespective of the duration of surgery⁶. The aim of this study was to predict the difficulty of LC and the possibility of conversion to OC before surgery using the clinical and ultrasonographic criteria in our set up.

Materials and methods

This work conforms to the values laid down in the Declaration of Helsinki (1964). The protocol of this study has been approved by the relevant ethical committee related to our institution in which it was performed. All subjects gave full informed consent to participate in this study.

This study was conducted in a Surgical Unit of VMMC and Safdarjung Hospital in New Delhi, India.

A total of 200 patients presenting with symptomatic gall stone disease between January 2011 and June 2012 were included in the study. Patients with a history of jaundice, previous upper abdominal surgery, palpable tender lump in

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Table 1 Duration of surgery in the presence or absence of pre-operative risk factors.

Pre-operative risk factors		N	%	Duration
Size and number of stones	Single	75	37.5	56.15 ± 9.45
	Multiple	125	62.5	45.55 ± 10.48
Gallbladder thickness	Thick	45	22.5	62 ± 10.72
	Normal	155	77.5	48.66 ± 9.12

Table 2 Access to peritoneal cavity according to the presence or absence of pre-operative risk factors.

Pre-operative risk factors	Access					
	N		Easy		Difficult	
			N	%	N	%
BMI	Obese	5	3	60	2	40
	Non-obese	195	190	97.4	5	2.5
Lower abdominal surgery	None	189	186	98.4	3	1.5
	Present	11	9	81.8	2	18.1

right hypochondrium, deranged liver function tests, dilated common bile duct (CBD) or CBD stones on ultrasound and those with medical comorbidities were not included in the study. Every patient included in the study was subjected to the following assessments, which were regarded as risk factors for LC.

Patients' characteristics (independent variables)

- Gender
- Age
- Weight, height and body mass index [BMI (kg/m²)]

Patients who had a BMI ≥ 35 were considered obese according to the international definition⁷.

Complaints, history and clinical examination

- Symptoms of pain, dyspepsia and vomiting
- Previous abdominal surgery was categorized as no versus any intra-abdominal surgery (excluding upper abdominal surgery).
- The clinical signs of cholecystitis: tender right hypochondrium, positive Murphy's sign and palpable gallbladder

Laboratory data included

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 included the following parameters:

- Shape of gallbladder: Gallbladder was defined as contracted or distended depending on the shape and transverse diameter. It was defined as distended if the transverse diameter was greater than 5 cm.
- Gallbladder wall thickness was estimated by using the maximal obtainable measurement (thick ≥3 mm vs. normal <3 mm).
- The calculus size (small <1 cm vs. large ≥1 cm)
- The number of calculi (solitary vs. multiple)
- Common bile duct (normal <8 mm vs. dilated ≥8 mm)
- Liver parenchyma (normal, fatty infiltration and liver fibrosis)

Operative parameters (dependent variables)

All cases underwent LC with assessment of the difficulties encountered in terms of:

- Duration of surgery (in min): Duration of surgery included the time from insertion of Veress needle to closure of the trocar insertion site and was evaluated as a continuous variable.
- 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/min without drop in blood pressure. Severe bleeding was defined as bleeding leading to tachycardia of greater than 100/min with a greater than 10 mm Hg drop in blood pressure.
- Access to peritoneal cavity: The operating surgeon described the access to peritoneal cavity as 'easy' or 'difficult'.
- Gallbladder bed dissection: The operating surgeon described gallbladder bed dissection as 'easy' or 'difficult'.
- Difficult extraction: Extension of incision for extraction. The operating surgeon described gallbladder extraction as 'easy' or 'difficult'.
- Conversion to OC.

Results

Amongst the 200 patients admitted for laparoscopic cholecystectomy, 47 (23.5%) were male and 153 (76.5%) female, with an average age of 39 years (range 16–62 years). The BMI ranged from 16.3 to 42.7 with a mean of 32.8 ± 6.28 kg/m². Five patients were considered obese (BMI > 35 kg/m²).

In this study, the total operative time ranged from 45 to 62 min. Prolonged operative time was statistically significant in cases with single large stone and thick-walled gallbladder ($p < 0.05$) (Table 1). Access to peritoneal cavity was difficult in seven cases mainly due to thick abdominal wall especially in the obese patients and two patients with previous lower abdominal surgery (Table 2).

Gall bladder dissection was difficult in 18.8% patients with previous lower abdominal surgery (Table 3).

Table 3 Gallbladder bed dissection according to the presence or absence of pre-operative risk factors.

Pre-operative risk factors	Gallbladder dissection					
		N	Easy		Difficult	
			N	%	N	%
Lower abdominal surgery	Absent	189	163	86.7	26	13.3
	Present	11	9	80.2	2	18.8
Gallbladder wall thickness	Thick	45	31	69.2	14	31.1
	Normal	155	145	93.5	10	6.45

Table 4 Bleeding during surgery according to the presence and absence of pre-operative risk factors.

Pre-operative risk factors	Bleeding during surgery					
		N	Easy		Difficult	
			N	%	N	%
Gallbladder wall thickness	Thick	45	37	83	8	17.7
	Normal	155	142	92	13	8.38

Table 5 Gallbladder extraction according to the presence and absence of pre-operative risk factors.

Pre-operative risk factors	Gallbladder extraction					
		N	Easy		Difficult	
			N	%	N	%
BMI	Obese	5	3	60	2	40
	Non-obese	195	170	87.18	25	12.82
Shape of gallbladder	Normal	183	165	90.1	18	9.8
	Distended	8	8	100	0	0
	Contracted	9	8	88.8	1	11.1
Gallbladder wall thickness	Thick	45	37	83.5	8	17.7
	Normal	155	135	87.1	20	12.9
Size and no of stones	Large	75	53	70.5	22	29.3
	Multiple	125	115	92.2	10	8

Bleeding during surgery was 17.7% in patients with thickened gall bladder than 8.38% in normal thickness gall bladder (Table 4).

Gallbladder extraction was difficult in two cases with BMI > 35 kg/m² (40%) and extension of incision was attempted only in one case (Table 5).

Gallbladder perforation occurred in eight patients (20%) and stone

spillage occurred in five patients (12.5%) and were all retrieved. Ten patients required conversion to open procedure; in the remaining cases the LC was successfully completed. The conversion rate in females was 4.5% (seven cases) and males was 6.3% (three cases). In patients with BMI >35 kg/m² who were considered obese, none of them had to be

converted. Gangrenous gallbladder was the reason for difficult LC in two patients, but no one needed to be converted. Eleven patients who had some sort of lower abdominal surgery in the form of appendectomy, caesarean section, laparotomy for Koch's abdomen, laparoscopic ligation and so on, one (9.09%) had to be converted into open due to dense abdominal adhesions. A total of nine patients (55.5%) had contracted and fibrotic gallbladder of which four patients (44.4%) had to be converted (Table 6).

Only one conversion was enforced due to CBD injury, which was identified intraoperatively, due to anatomical variation and dense adhesions and managed in the same sitting.

Discussion

In the perspective of LC being the gold standard treatment of symptomatic cholelithiasis, preoperative prediction of the risk of conversion is an important aspect in the planning for laparoscopic surgery. Several studies have been published in the past years trying to assess risk factors for difficult LC^{7,8}. The clinical profile of a patient can predict a difficult gallbladder surgery. Conversion to open surgery is an indication of sound judgement of the surgeon in view of safety of the patient.

Age is recognised as a risk factor of conversion^{3,10-16}. We and some other authors did not notice age to be associated with conversion rate^{11,12}. This varied opinion could be attributed to surgeon's experience and expertise. A 4.5% female and 6.3% male patients underwent conversion to open. Lein and Huang concluded that male gender is a risk factor for severe symptomatic cholelithiasis⁹.

Morbid obesity is known to be associated with difficult surgery and increased risk for conversion^{9,10,16-19}. None of our obese patients had to be converted into open. Simopoulos et al. declared that LC is effective and safe in patients with morbid obesity²².

Table 6 Conversion to laparotomy with respect to pre-operative risk factors.

Pre-operative risk factors	Conversion to laparotomy					
	Completed laparoscopic surgery			Conversion		
		N	N	%	N	%
Gender	Female	153	146	95.42	7	4.5
	Male	47	44	93.6	3	6.3
BMI	Obese	5	5	100	0	0
	Non-obese	195	185	100	10	5.12
Lower abdominal surgery	Absent	189	180	95.2	9	4.7
	Present	11	10	90.9	1	9.09
Shape of gallbladder	Normal	191	185	96.8	6	3.1
	Contracted	9	5	55.5	4	44.4
Gallbladder thickness	Thick	45	42	93.3	3	6.6
	Normal	155	148	95.4	7	4.5

Table 7 Comparison of conversion rate in various series in different parts of the world.

Author	Country	N	Conversion rate
Kuldip et al. ²⁵	India	6147	0.36% (1.66% in difficult cases)
Lim et al. ²⁶	Singapore	149	11.5%
Ishizaki et al. ²⁷	Japan	1179	5.3% (10.6% in difficult cases)
Bakos et al. ²⁸	Slovakia	1535	5.7%
Waseem et al. ²⁹	Pakistan	216	4%
Rosita et al. ³⁰	Iran	793	9%
This study	India	200	5%

Association of duration of symptoms with conversion has also been evaluated. In a study of 738 patients, Jansen et al.²¹ found contracted gallbladder to be statistically significant for risk of conversion. In our study, four patients with contracted gallbladder underwent OC. Hutchinson et al., Liu et al. and Kama et al. considered gallbladder thickness to be the most important sonographic risk factor of conversion to OC²²⁻²⁴. Many authors found statistical significance between the size of stones and conversion^{9,10}. We also found the same, but Jansen et al.²¹ found that stone size >20 mm was associated with increased risk of conversion.

Conversion to OC in our study was resorted to in 10 patients (5%) undergoing LC, which is in accordance

with the literature (2%–9%). Table 7 shows the comparison of conversion rate reported by different studies in different places in the world²⁵⁻³⁰.

Failure to identify the anatomy during dissection was encountered in patients with previous acute cholecystitis. Prior acute cholecystitis results in a scarred and fibrosed gallbladder and in dense fibrotic adhesions that render laparoscopic dissection difficult.

Livingstone and Rege showed that acute cholecystitis was associated with a conversion rate of 25%³¹. The finding that ultrasonographic signs of inflammation are risk factors for conversion is consistent with previously demonstrated studies that radiographic findings of inflammation increases the risk of conversion to OC^{3,32-35}.

Conclusion

It can be concluded that LC is the gold standard for the management of gall stone disease. With the advancement in equipment and gaining experiences in laparoscopy, most of the difficult gallbladder can be dealt laparoscopically. Preoperative risk factors can help to predict difficult gallbladder and conversion to OC. Male gender, single large stone, thick-walled gallbladder, previous abdominal surgery and contracted gallbladder are the factors that proved to be significant in our study. These factors can predict difficulty to be encountered during surgery and help in making a decision for conversion thus shortening the duration of surgery and preventing unnecessary complications.

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