Original Research Article

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Prediction of difficulties during laparoscopic cholecystectomy by preoperative clinical examination and ultrasonography

Arun Kumar¹, Kunwar Vishal Singh^{1*}, Jugendra Pal Singh Shakya¹, Sangita Sahu², Soniya Dhiman², Neelabh Agrawal¹

¹Department of Surgery, ²Department of Obstetrics and Gynaecology, S. N. M. C., Agra, Uttar Pradesh, India

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*Correspondence:

Dr. Kunwar Vishal Singh,

E-mail: kvsraikwar06@gmail.com

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ABSTRACT

Background: Cholelithiasis (gall stone disease) is a well-known disease worldwide. Ultrasonography is the most common screening test for cholecystitis and cholelithiasis. Laparoscopic Cholecystectomy is considered the treatment of choice for symptomatic gall stone disease. It is important to know the different clinical, radiological parameter and specific predictor that give some prediction of difficult LC. 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.

Methods: The present study was carried out in the Department of surgery. Sarojini Najdu Medical College Agra

Methods: The present study was carried out in the Department of surgery, Sarojini Naidu Medical College Agra, from November 2014 to October 2016. A total of 210 patients were enrolled for the laparoscopic cholecystectomy. All patients who were included in the study were undergone detailed history and clinical examination. A number of clinical and ultrasonographical parameters were noted.

Results: Amongst the 210 patients admitted for laparoscopic cholecystectomy, 21 (10%) were male and 189 (90%) female, with age ranging from 12–60 years. The conversion rate in our study was 4.5% (9 of 210). In our study significant pre-operative factors which increased the conversion rate to open cholecystectomy includes male gender, obesity, abdominal scar of previous surgery, contracted and thickened gall bladder and patients having stone impacted at the neck of gall bladder.

Conclusions: From this study, we conclude that preoperative ultrasonography is a good predictor of difficult laparoscopic cholecystectomy in the majority of cases and should be used as a screening procedure.

Keywords: Laparoscopy cholecystectomy, Open cholecystectomy

INTRODUCTION

Cholelithiasis (gall stone disease) is a well-known disease worldwide. Its estimated incidence is 1.39/100 person/year, varying little between populations. Ultrasonography is the most common screening test for cholecystitis and cholelithiasis. Cholecystectomy is considered the treatment of choice for symptomatic gall stone disease. Laparoscopic cholecystectomy (LC) has gradually replaced open cholecystectomy (OC) in the treatment of symptomatic gall stone disease and accepted as the gold standard. Better cosmetic results, short

hospital stay, early recovery and return to physical activity and work, all have contributed to the popularity of this technique. In the beginning, patients with acute cholecystitis, empyema, gangrenous gallbladder, cirrhotic patients and Mirizzi syndrome, previous upper abdominal surgery, and morbid obesity were considered as contraindications for carrying out LC. With growing experience most of the previous contraindications such as morbid obesity, previous upper abdominal surgery and acute cholecystitis are no longer absolute. The term difficult cholecystectomy refers to multiple technical intra-operative difficulties that increases the risk of

complications and significantly prolongs operation time. 8,9 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 intra-operative difficulties expected to be encountered. 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.

METHODS

The present study was carried out in the Department of surgery, Sarojini Naidu Medical College Agra, from November 2014 to October 2016 to predict the intradifficulties during Laparoscopic Cholecystectomy and possibilities of conversion to Open Cholecystectomy by preoperative clinical examination and ultrasonographic findings. A total of 210 patients of all age group and both sex with symptomatic Gall stone enrolled disease were for the laparoscopic cholecystectomy. Patients with common bile duct stone, jaundice or abnormal liver function test, acute cholecystitis, acute pancreatitis, known carcinoma gall bladder, peritonitis, cholangitis, biliary enteric fistula, portal hypertension and contraindication to laparoscopic surgery were excluded from the study. All enrolled patients were undergone detailed history and clinical examination. All routine investigations including liver function test, coagulation profile and pre-operative ultrasound were done. Patients were followed up after surgery to find out any post- operative complication. Findings which were noted includes gender, age, weight, height and body mass index (BMI). Patients who had a BMI \geq 30 were considered obese according to the international definition. Previous abdominal surgery was categorized as no versus any intra-abdominal surgery. On pre-operative ultrasound following criteria was assessed:

- 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 versus large ≥ 1 cm)
- The number of calculi (solitary versus multiple)
- Common bile duct (normal <6 mm versus dilated ≥6 mm)
- Stone impacted at neck of gallbladder or not
- Liver parenchyma (normal, fatty infiltration and liver fibrosis)
- Any evidence of acute cholecystitis and acute pancreatitis.

Procedure was explained to the selected patients and written informed consent was taken. The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software. p value of <0.005 was considered significant.

RESULTS

Amongst the 210 patients admitted for laparoscopic cholecystectomy, 21 (10%) were male and 189 (90%) female, with age ranging from 12–60 years. In our study 12 patients were considered obese (BMI>30 kg/m 2).

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

Pre-operative clinical risk factors		N	%	Duration of surgery (Mean±SD)	p value	
Age	≤35 years	99	47.14	76.36±14.50	< 0.0001	
	> 35 years	5 years 111 52.86 95.0±15.75		95.0±15.75	<0.0001	
Gender	Female	189	90.00	84.92±17.36	0.012	
Gender	Male	21	10.00	96.43±18.52		
BMI	Non- obese (<30)	198	94.29	84.46±16.05	0.0009	
DIVII	Obese (>30)	12	5.71	112.50±23.79		
Abdominal scar mark	Infra-umbilical	81	38.57	97.04±15.51	< 0.0001	
	Supra-umbilical	3	1.43	125.0±0		
	No scar mark	126	60.00	77.93±13.85		
Shape of gall bladder	Normal	105	50.00	76.71±12.82		
	Distended	36	17.14	87.92±12.15	0.0001	
	Contracted	69	32.86	100.00±17.85		
Gall bladder wall thickness	Normal	138	65.71	78.15±12.08	< 0.001	
	Thick	72	34.29	101.96±16.72	<0.001	
Size of calculus	≤10 mm	84	40.00	78.21±13.85	< 0.0001	
Size of calculus	>10 mm	126	60.00	91.46±18.19	<0.0001	

Table 2: Access and dissection of calots triangle in presence or absence of pre-operative risk factors.

Pre-operative risk factors		N	Access and dissection of calots triangle				p-value	
			Normal (1	Normal (N = 96)		Difficult $(N = 114)$		
			N	%	N	%		
Age	≤35 years	99	66	66.67	33	33.33	< 0.001	
	> 35 years	111	30	27.02	81	72.9	< 0.001	
BMI	Non- obese (<30)	198	94	47.47	104	52.53	0.03	
	Obese (>30)	12	2	16.67	10	83.33	0.05	
abdominal scar mark	Infra-umbilical	81	3	3.70	78	96.3	_	
	Supra-umbilical	3	0	0	3	100	< 0.001	
	No scar mark	126	93	73.8	33	26.1		
	Normal	105	72	68.57	33	31.43	_	
Shape of gall bladder	Distended	36	15	41.67	21	58.3	< 0.001	
	Contracted	69	9	13.04	60	86.95		
GB wall thickness	Normal	138	84	60.86	54	39.14	< 0.001	
	Thick	72	12	16.67	60	83.33	<0.001	

Table 3: Dissection of gall bladder from gall bladder fossa in presence or absence of pre-operative risk factors.

Pre-operative risk factors		N	GB bed dissection					
			Normal (N	(= 114)	Difficult (N = 96)		p-value	
			N	%	N	%		
Age	≤35 years	<35 years	N = 99	75	75.75	24	< 0.001	
	> 35 years	>35 years	N = 111	39	35.14	72	- <0.001	
abdominal scar mark	Infra-umbilical	81	30	37.04	51	62.96	<0.001	
	Supra-umbilical	3	0	0	3	100		
	No scar mark	126	84	66.67	42	33.33		
Shape of gall bladder	Normal	105	72	68.57	33	31.43	<0.001	
	Distended	36	15	41.67	21	58.3		
	Contracted	69	9	13.04	60	86.95		
GB wall thickness	Normal	138	111	80.43	27	19.57	<0.001	
	Thick	72	3	4.12	69	95.84		
Size of calculus	<10 mm	84	66	78.57	18	21.43	<0.001	
	>10 mm	126	48	38.1	78	61.9		

Table 4: Extraction of gall bladder in presence or absence of pre-operative risk factors.

Pre-operative risk factors		Extraction of GB					n malma	
		N	Normal (N = 108)		Difficult (N = 102)		p-value	
			N	%	N	%		
A co	≤35 years	99	66	66.67	33	33.33	<0.001	
Age	> 35 years	111	42	37.84	69	62.16		
Abdominal scar mark	Infra-umbilical	81	36	44.44	48	55.56	<0.017	
	Supra-umbilical	3	0	0	3	100.00		
	No scar mark	126	72	57.14	51	42.86		
Shape of gall bladder	Normal	105	72	68.57	33	31.43	<0.001	
	Distended	36	12	33.33	24	66.67		
	Contracted	69	24	34.78	45	65.22		
GB wall thickness	Normal	138	93	67.39	45	32.61	<0.001	
	Thick	72	15	20.83	57	79.17		
Size of calculus	<10 mm	84	84	100	0	0	رم مرم 1 مرم م	
	>10 mm	126	24	19.04	102	80.96	< 0.001	

Pre-operative risk factors		N	Completed surgery (N	l laparoscopic = 201)	Converted to laparotomy (N = 9)		p value
			N	%	N	%	
Gender	Female	189	185	97.88	4	2.12	< 0.001
Gender	Male	21	16	76.19	5	23.80	<0.001
BMI	Non- obese (<30)	198	192	96.96	6	3.04	<0.001
	Obese (>30)	12	9	75	3	25	
	Infra-umbilical	84	79	94.05	5	5.95	
Abdominal scar mark	Supra-umbilical	3	1	33.33	2	66.67	<0.001
	No scar mark	123	121	98.37	2	1.63	
Shape of gall bladder	Normal	105	105	100	0	0.00	
	Distended	36	35	97.22	1	2.78	< 0.001
	Contracted	69	61	88.40	8	11.6	
GB wall thickness	Normal	138	138	100	0	0	رم مرم دم مرم
	Thick	72	63	87.5	9	12.5	< 0.001

17

184

Table 5: Conversion rate in presence or absence of pre-operative clinical risk factors.

In this study, the total operative time ranged from 60 to 150 minutes. Prolonged operative time was statistically significant in cases with age > 35 years, male gender, obese patients, with abdominal scar, single large stone and contracted thick-walled gallbladder (p < 0.05) (Table 1). Access and dissection of calot's triangle was difficult in 114 cases mainly due to age > 35 years, thick abdominal wall especially in the obese patients and 84 patients with previous abdominal surgery (Table 2), thickened contracted gall bladder.

Impacted

Not impacted

21

189

Gall bladder dissection was difficult in 90 cases mainly due to age > 35 years, patients with previous abdominal surgery (Table 3), thickened contracted gall bladder, larger size of stone. Gall Bladder extraction was difficult in 96 cases mainly due to age > 35 years, patients with previous abdominal surgery (Table 4), thickened contracted gall bladder, larger size of stone.

In our study significant pre-operative factors which increased the conversion rate to OC include male gender, obesity, abdominal scar of previous surgery, contracted and thickened gall bladder having stone impacted in the neck of gall bladder (Table 5).

DISCUSSION

Calculas impacted at

neck of GB

In the present era, laparoscopic cholecystectomy accepted as the gold standard treatment of symptomatic cholelithiasis. For planning of laparoscopic surgery preoperative prediction of the risk of conversion is an important aspect. In the past years various studies have been published to assess risk factors for difficult LC. ^{10,11} The clinical profile of a patient can predict a difficult gallbladder surgery. According to the literature age is a risk factor for difficult GB surgery. ¹² Our findings are in accordance with previous studies. In previous studies age

is also recognized as a risk factor for conversion.^{6,13-18} But we and some other authors did not notice age to be associated with conversion rate.^{13,14}

5

19.05

2.67

< 0.001

80.95

97.35

In studies done worldwide, male sex has been described to be associated with difficult LC.¹⁹ Lein and Huang concluded that male gender is a risk factor for severe symptomatic cholelithiasis.²⁰ In the present study, there were 21 males (10%) and 189 females (90%) and we found that total time taken for the procedure and conversion rate to laparotomy was significantly higher for men than women , a finding that has been reported previously.^{12,21-24} The reason for the increased risk of conversion for men is not clear. More frequent association with severe, acute and chronic disease has been postulated.²⁴

Obese patients may have a difficult laparoscopic surgery due to difficult port placement in thick abdominal wall, difficult dissection of calot's triangle because of obscure anatomy and difficulty in the manipulation of instruments through an excessively thick abdominal wall.²⁵ In our study, we found that duration of surgery was significantly longer, access and dissection of calot's triangle was also significantly difficult and there was increased risk of conversion to laparotomy in obese patient in comparison to non-obese patients.

In present study previous abdominal surgery also causes a significant difficulty mainly due to adhesion formation similar to the findings shown by underwood et al.²⁶ We found that patients having abdominal scar mark of previous surgery have significantly increased duration of surgery, difficult access and dissection of calot's triangle, GB bed dissection and extraction of gall bladder when compared with patients with no scar. The contracted gall bladder is another important predictive factor for difficult

laparoscopic cholecystectomy. Patients with a small contracted gall bladder or a trabeculated gall bladder due to heavy stone load and multiple criss cross strictures in the gall bladder lumen, are also candidates at risk where the surgeon would have difficulty in holding the gall bladder.²⁷ In our study we found that patients having thickened contracted gall bladder have significantly increased duration of surgery, difficult access and dissection of calot's triangle, GB bed dissection and extraction of gall bladder. The thickened and contracted gallbladder was difficult to dissect because it had dense adhesions with the surrounding structures and in calot's triangle. In a study of 738 patients, Jansen et al found contracted gallbladder to be statistically significant for risk of conversion.¹⁵ We also found that there was increased risk of conversion to laparotomy in patients having thick and contracted gall bladder. Hutchinson et al, Liu et al and Kama et al considered gallbladder thickness to be the most important sonographic risk factor of conversion to open cholecystectomy. 6,21,28 In our study we found that, out of 9 patients converted to laparotomy, all 9 (12.5%) were having thick gall bladder wall. This data was found to be highly significant statistically (p<0.0001).

Our study shows that number of calculus in the gall bladder did not have any significant impact on duration of surgery and conversion rate. Patients having larger size of stone showed difficulty in GB extraction because, it generally needs incision extension. Many authors found statistical significance between the size of stones and conversion. Jansen et al found that stone size >20 mm was associated with increased risk of conversion. But no significant association between size of calculus and conversion rate was found in our study. Is

The main difficulty with stone impacted at the neck or Hartman's pouch is that it hinders holding of the gallbladder during dissection, and also due to impacted stone, the gallbladder is distended with mucus forming the mucocele of the gallbladder, which is even more difficult to hold. In our study we found a significantly increased conversion rate when stone was impacted at GB neck.

Common bile duct size also has a good correlation with conversion to the open procedure and difficulty in surgery, in accordance with findings from previous studies difficult laparoscopic cholecystectomy is defined in those procedures which exceed 90 minutes in duration and or are converted to open procedure. In our study significant factors which increased the operating time were, age more than 35 years, male gender, obesity, previous abdominal surgery, contracted gall bladder, thick gall bladder wall and large calculi.

The conversion rate in our study was 4.5% (9 of 210), which compares well with the incidence reported in the literature, which varies from 2% to 15%.²⁹ The major risk factors for conversion in previous studies included male

sex, obesity, and cholecystitis, dense pericholecystic adhesion or unclear anatomy, uncontrolled bleeding and thick fibrosed gall bladder.^{22,30-32} In our study significant pre-operative factors which increased the conversion rate to open cholecystectomy includes male gender, obesity, abdominal scar of previous surgery, contracted and thickened gall bladder having stone impacted in the neck of gall bladder.

Conversion should not be considered a failure or complication, but in fact a means of preventing complications when safe completion of the laparoscopic procedure cannot be ensured.

CONCLUSION

From this study, we conclude that preoperative ultrasonography is a good predictor of difficulty in laparoscopic cholecystectomy in the majority of cases and should be used as a screening procedure. It can help surgeons to get an idea of the potential difficulty to be faced in that particular patient. The most valuable assessment the ultrasound can provide is gallbladder wall thickness, gallbladder size, stone size, common bile duct diameter, common bile duct stones, and any abnormal anatomy of the biliary tract, if present.

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