



ORIGINAL RESEARCH PAPER

Surgery

PREDICTORS OF DIFFICULT LAPAROSCOPIC CHOLECYSTECTOMY-A CLINICAL STUDY

KEY WORDS: Laparoscopic cholecystectomy, conversion to open,

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ABSTRACT

Background: Gallstones are one of the common surgical problems throughout the world. Laparoscopic cholecystectomy has become the gold standard in the treatment of cholelithiasis. However in 2% to 15% of patients laparoscopic cholecystectomy are converted to open cholecystectomy because of technical difficulty or intraoperative complications.
Objective: To evaluate clinical and ultrasonographic parameters as predictors of difficult laparoscopic cholecystectomy and to correlate these predictors with operative findings and surgical outcomes.
Methods: This hospital based cross-sectional study was conducted from June 2016 to December 2016 in B.P.K.I.H.S., Dharan, Nepal. All cases (n=63) with cholelithiasis admitted for Laparoscopic cholecystectomy were included. Following data were recorded in the performa for study: Age, sex, obesity of the patients, previous abdominal surgery and past history of acute attack of cholecystitis, Ultrasonographical findings of gall bladder, thickened gall bladder wall and number of stones and intraoperative cause for the conversion.
Results: Difficulty was seen in all age groups, but conversion rate was higher in above 50 years., BMI greater than 30 kg/m2 (overweight patient) had higher chances of difficult laparoscopic cholecystectomy and conversion was also more in this group. Thickened GB wall greater than 3 mm, multiple stones and stone impacted in Hartmann's pouch were factors responsible for difficult LC. Perforation of gall bladder during surgery with bile leak and or dropped stone leads to difficult LC.

INTRODUCTION

Gallstones are one of the common surgical problems throughout the world. It occurs in all ethnic and racial groups with wide variation in its incidence and prevalence¹¹ By the age of 75 years about 35% of women and 20% of men develop gallstone. Women are more likely to develop gall stone than men especially during their reproductive period and it is 2 to 3 times higher than men, attributed to level of estrogen.

Laparoscopic cholecystectomy has become the gold standard in the treatment of cholelithiasis. Less postoperative pain, early oral intake after surgery, shorter hospital stay, early resumption of normal activity and improved cosmesis have been well recognized advantages of laparoscopic cholecystectomy¹³. However in 2% to 15% of patients laparoscopic cholecystectomy are converted to open cholecystectomy because of technical difficulty or intraoperative complications¹⁷.

Preoperative prediction of difficult laparoscopy is an important aspect of planning laparoscopic cholecystectomy. Identification of risk factors helps to predict the risk of conversion for selected patients, prepare the patient psychologically for surgery, arrange operating schedule accordingly and minimize the procedure related cost and help overcome financial constraints which is an important aspect in developing country. The current study was aimed to identify various factors which can predict difficult laparoscopic cholecystectomy and an early conversion can be considered. Though conversion rate indicates the difficult laparoscopic cholecystectomy, however all difficult laparoscopic cholecystectomy may not end into conversion⁵.

MATERIALS AND METHODS

This hospital based cross-sectional study was conducted from June 2016 to December 2016 in B.P. Koirala Institute of Health Sciences, Dharan, Nepal. All cases (n=63) with cholelithiasis admitted for Laparoscopic cholecystectomy were included. Patients who didn't want to take part in this study, associated chronic diseases(Diabetes mellitus, significant cardiac, renal and pulmonary diseases), who wanted open cholecystectomy, with hepatobiliary malignancies, acute cholecystitis, choledocholithiasis or significant Portal Hypertension were excluded.

A detailed history of patients, through clinical examinations and routine investigations were performed. Following data were recorded in the performa for study: Age, sex, obesity of the patients, previous abdominal surgery and past history of acute attack of cholecystitis, Ultrasonographical findings of gall bladder, thickened gall bladder wall and number of stones and intraoperative cause for the conversion.

Computer compilation of the data was done. Afterwards data processing, analysis and comparison were done with the help of necessary software programmed as Statistical Package for Social Sciences. P-value less than 0.05 were considered as significant.

RESULTS

Total number of cases in this study were 63, out of which difficult laparoscopic cholecystectomy were seen in 25(39.68%) cases and 7(11.11%) patients required conversion open cholecystectomy.

Fig 1: No of difficult cases. n=63

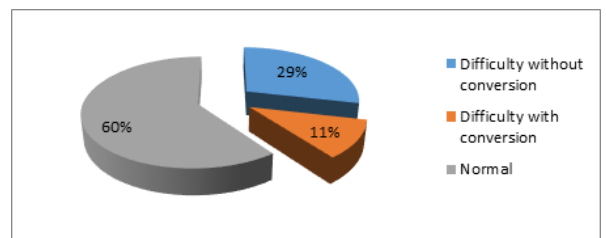


Table 1: Sex Vs. Conversion and difficulty

Sex	Difficulty	Conversion
Male(n=10)	3(30%)	0(0%)
Female(n=53)	22(41.5%)	7(13.2%)

Fig 2(a): age group and difficult cholecystectomy. n=63

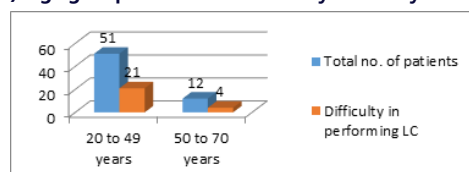


Fig 2(b): conversion and difficult LC. n=25

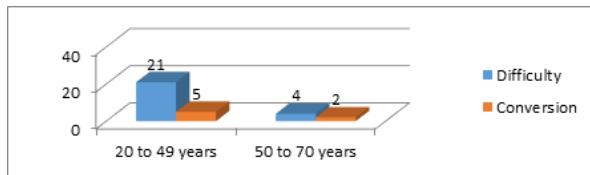


Table 2: Relationship between BMI and difficult LC

BMI (kg/m ²)	Difficulty on performing LC		Total (%)	p value
	No (%)	Yes (%)		
Normal weight	35(66)	18(34)	53 (100)	0.033
Over weight	3(30)	7(70)	10 (100)	
Obese	0(0)	0(0)	0(0)	
Total	38(60.30)	25(39.70)	63 (100)	

Table no 3: Relationship between BMI and conversion to OC

BMI (kg/m ²)	Conversion to open cholecystectomy		Total (%)	p value
	No (%)	Yes (%)		
Normal weight	49 (92.45)	4 (7.55)	53 (100)	0.038
Over weight	7 (70)	3 (30)	10 (100)	
Obese	0(0)	0(0)	0(0)	
Total	56(88.8)	7(11.2)	63 (100)	

No of attacks of acute cholecystitis

Fig 3(a): Relationship between no. of attack of acute cholecystitis and difficult LC.

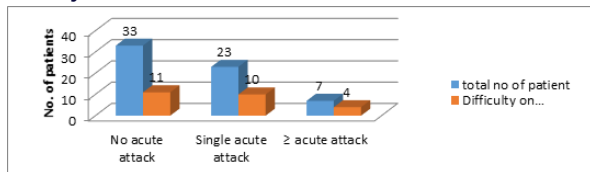


Fig 3(b): Relationship between no. of acute attack and conversion in difficult LC.

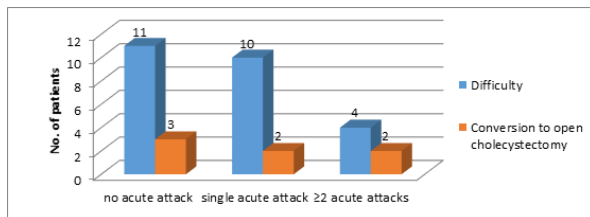


Table 4: Predictive value of ultrasonography on observations. n=63

USG finding	Difficult LC		Conversion to OC	
	Yes (%)	No (%)	Yes (%)	No (%)
Wall thickness				
<3mm n=44	15(34)	29(66)	2(4.5)	42(95.5)
≥3mm n=19	10(52.6)	9(48.4)	5(26.3)	14(73.68)
p-value	0.167		0.012	
No of stones				
Single n=16	6(37.5)	10(62.5)	1(6.25)	15(93.75)
Multiple n=47	19(40.4)	28(59.6)	6(12.75)	41(87.25)
p-value	0.0001		0.0001	
Stone in Hartman's pouch				
Present n=10	7 (70)	3(30)	2(20)	8(80)
Absent n=53	18(33.95)	35(66.05)	5(9.43)	48(90.57)
p-value	0.0001		0.0001	
Overall difficulty prediction with USG				
Difficult LC n=12	9(75)	3(25)	4(33.33)	8(66.67)
Easy LC n=51	16(31.37)	35(69.63)	3(5.88)	48(94.12)
p-value	0.0001		0.0001	

Intraoperative cause of difficulty:-

(a)Biliary anatomy

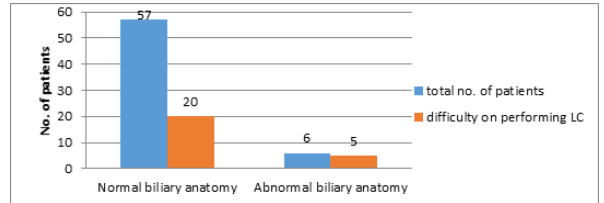


Fig 4(a): Relationship of biliary anatomy and difficult LC n=63

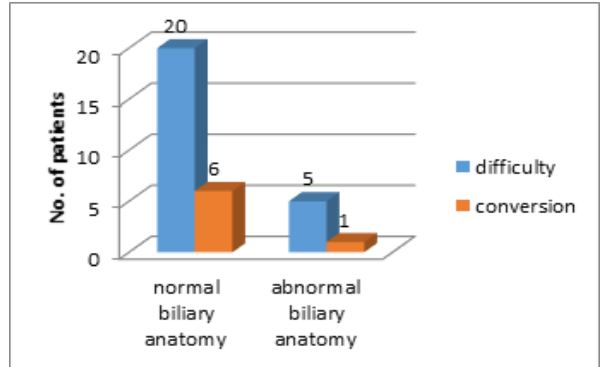


Fig 4(a): Relation of conversion in difficult LC n=25

(b)Length of cystic duct:

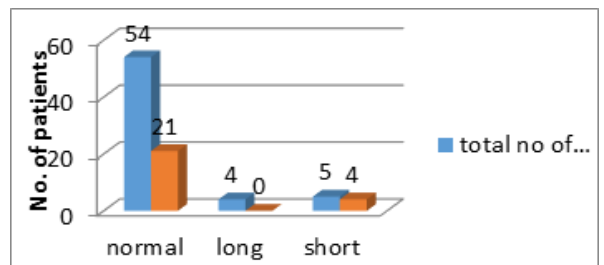


Fig 5(a): Relationship of cystic duct anomalies and difficult LC. n=63

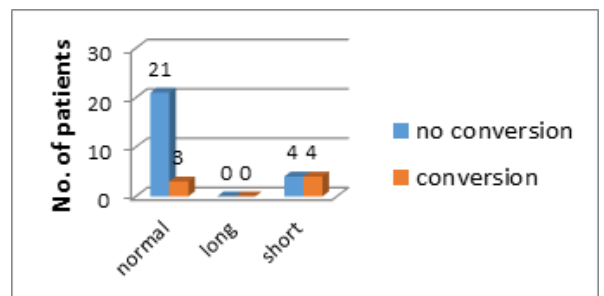


Fig 5(b): Relationship of Anomalies of cystic duct with conversion. n=25

Intraoperative causes for difficult LC

Table 5: Adhesion and difficult LC. n=63

	Difficult LC		Conversion to OC	
	Yes (%)	No(%)	Yes(%)	No(%)
Adhesion				
Absent	20(36.4)	35(63.6)	6(11)	49(89)
Present	5(62.5)	3(37.5)	1(12.5)	7(87.5)
p-value	0.305		1.00	

Table 6: GB perforation and difficult LC. n=63

GB perforation	Difficult LC		conversion to OC	
	Yes (%)	No (%)	Yes (%)	No (%)
No perforation	19(33.3)	38(66.7)	7(12.3)	50(87.7)
Bile leak only	4(100)	0(0)	0(0)	4(100)
Dropped stone	2(100)	0(0)	0(0)	2(100)
p-value	0.006		0.661	

DISCUSSION

Clear benefits of laparoscopic cholecystectomy such as reduction in postoperative disability, cosmesis and early return to work have rendered it the procedure of choice for symptomatic cholelithiasis. As the experience with the operation grew, its indication expanded progressively to more complex and high-risk patients. With more frequent application of the procedure, it is expected that greater number of procedure would be difficult and might have to be converted to open cholecystectomy¹.

The chance of unwanted "surprise" waiting for surgeon during laparoscopic cholecystectomy, such as dense adhesions and aberrant anatomy, are the same as those encountered during open cholecystectomy. However, conversion to open procedure is inevitable in some case of laparoscopic cholecystectomy when surgeon faces difficulty. If there is benefit of reliable preoperative predictive factors, difficulty during procedure and chance of conversion can be estimated and patient can be informed of these possibilities and can be mentally prepared¹³.

Higher incidence of difficult LC and higher conversion rate in male patients have been reported which varied from 5.9% to 41% as compared to 7.18% to 59% in female^{1,2,3}.

Kama et al. reported incidence of conversion in 32% male and 11.2% female¹. Similar results were reported by Nachnani et al. and Lipman et al.^{2,4}. However in present study conversion was not required in any male patients but 13.2% (7 cases) patients out of 53 female required conversions (Table 1). This may be explained by the fact that sample size of male was small in present study. However Kumar et al. Liu et al. and Rosen et al. did not find significant difference in conversion rate in either sex which ranged from 10.41% to 41% in male as compared to 7.18 to 59% in female^{5,6,7}.

No convincing explanation has been put forward in mentioned studies. However Kama et al. suggested that Male patients had more intense inflammation or fibrosis resulting in more difficult dissection both in the triangle of Calot and through the plane between gall bladder and liver, when compared with Female patients with similar history¹.

Many workers found age more than 60 years as predictor of difficult cholecystectomy^{1,6}. Kama et al. reviewing 1000 cases found 41.7% were more than 60 years of age and had conversion rate of 7% as compared to 3.9% in patients <60 years of age¹. Most of the patients (80.96%) in this study were less than 50 years and only 19.04% were more than 50 years of age. Difficult laparoscopic cholecystectomy was in 33.3% and conversion rate was 16.6% as compared to 9.8% in patient's age < 50 years of age (Fig 2(a,b)). These findings are consistent with the result reported in literatures.

Many authors had suggested that the reason for older age being risk factors is a longer history of gallstones and increased number of acute attacks of cholecystitis. Besides, elderly patients have a higher likelihood of complicated biliary pathology^{8,9,10}.

Many researcher reported higher conversion rate with difficult LC in obese patients^{11,2,6,12}. Liu et al. reported 25% of conversion in patients with morbid obesity, whereas Nachnani et al. noticed BMI >30 as significant predictor of difficult cholecystectomy⁷. However in present study there were no patients with BMI >30 kg/m² (obese group). There were 10 patients with BMI between 25 to 30 kg/m² (over weight patients) and 30% of these were difficult cholecystectomy, out of which 3 (30%) required conversion as compared to 7.5% in normal weight group (with BMI between 18-24.9 kg/m²) making overweight patients a predictor of difficult LC (Table 2).

However, study of Alponat et al. and Kama et al. did not observe higher conversion rate in obese patients. The criterion taken for obesity in their study was body weight \geq 80 kg. Patient were considered as non-obese with weight <80 kg. This may be the reason for discrepancy in their result as compared to other workers

who based obesity on BMI^{13,1}.

Kumar et al. in 2008 while reviewing 512 patients undergoing LC reported 35.15% (150 cases) had previous history of acute cholecystitis. The conversion rate was 15.6% as compared to 3.6% in group without previous attack of cholecystitis⁵. Tayeb et al. observed conversion rate with past history of cholecystitis as 8.2% as compared to 4.1% in patients without history of cholecystitis¹⁴. In the study under discussion, out of 63 patients, 30 patients had history of previous attack of cholecystitis and difficult LC was encountered in 46.7% cases. The conversion to OC was required in 13.33% cases. Among the patients with \geq 2 attacks of acute cholecystitis in past (7 cases) 57.14% had difficult laparoscopic cholecystectomy, whereas conversion to open procedure was required in 28.57% patients (Fig 3(a)).

The relationship between number of attack of cholecystitis and difficulty encountered during surgery is more specific. The difficulty during LC and conversion rate is less in patients with one attack of cholecystitis as compare to those who had two or more attacks. Out of 63 patients in present series single attack of cholecystitis was seen in 23 patients, out of which (43.5% (10 cases) had difficult LC and 8.7% (2 cases) required conversion, as compared to those patients (7 cases) who had more than one attack, difficulty was encountered in 57.1% and 28.67% required conversion (Fig 3(b)).

Past history of cholecystitis and number of attack of cholecystitis is significant predictors of difficult laparoscopic cholecystectomy. Dense adhesion, oedematous gall bladder or friable gall bladder are main cause of difficulty. Alponat et al. observed that oedematous inflamed gall bladder make exposure of Calot's triangle poor. Another problem interfering with good exposure is dense highly vascular adhesions present in this area¹⁵.

Thick wall gall bladder is strongly associated with higher conversion rate during LC^{6,7,2,15}. Minimal gall bladder wall thickness beyond which there is increased incidence of conversion was reported to be 4mm, by Kumar et al.⁵ and others⁷. However Kama et al. considered gall bladder wall thickness as 3mm as significant¹. The reported incidence of conversion rate varies from 29.4% by Kumar et al. and 30.8% by Kama et al. and 32.8% by Roosen et al. Slightly lower incidence reported by Kumar et al. can be explained as these workers considered a 4mm thickness as compared to others who considered 3mm thickness as significant^{5,17}.

In the present study out of 63 patients 19 had evidence of gall bladder wall thickness >3mm, out of which 52.63% (10 patients) had difficulty during procedure and 26.32% (5 patients) were converted to OC as compared to 4.5% in normal gall bladder (Table 4). This finding is in agreement with those reported in literature by various authors^{4,2,10}. The conversion rate in series of Liu et al. was reported to be 13.1% in thick wall gall bladder as compared to 7.2% in normal gall bladder, however, they considered gall bladder thickness as 4mm as significant⁶.

There are conflicting reports between number of stones and conversion rate. Kumar et al. in 2008 reported single stone has more chances of conversion than those with multiple, incidence being 13.3% and 5.2% respectively⁵. However subsequent studies by Gabriel et al. in 2009 reported higher incidence of conversion in multiple stones as compared to single stone. The conversion rate in multiple was 34%¹⁷. In the present study 74.6% (47 cases) patients had multiple stones, where difficulty during LC was encountered in 40.4% (19 cases) patients while conversion rate was 12.75% as compared to 6.25% in patients with single stones (Table 4). These results are comparable to others^{17,14}.

Jansen et al. reported size of stone >20mm and those impacted at Hartmann's pouch were associated with difficult LC¹⁸. We also encountered stone impacted at Hartmann's pouch in 15.8%(10) cases out of which difficulty during the procedure was found in 30% (3 cases) and 20% (2 cases) were converted to OC. Impacted stones at Hartmann's pouch makes dissection difficult because of difficulty in holding gall bladder at Hartmann's pouch.

Adhesions in Calot's triangle results in disturbed anatomy of the area. Difficulty occurs in identifying the cystic artery and cystic duct because of adhesions. Various authors reported incidence of 27.9% to 78.9% conversion rate in presence of adhesions in calot's triangle and inability to identify anatomy correctly^{17,19,20}. In present study there were 12.7% cases where adhesions were present in Calot's triangle. Out of these 62.5% had difficult LC but conversion to OC was required in 12.5% only. The lower rate of conversion in this study may be due to the fact that most patients belong to young age group and had single attack of cholecystitis in past (Table 5).

Chances of injury to gall bladder during surgery occurs due to inability to hold gall bladder with grasping forcep because of oedematous, friable or thin walled gall bladder. Incidence of spillage of bile and dropped stones has been reported as 0.57% to 7% in literatures. Though spillage of bile and dropped stones leads to difficulty in LC, however conversion is rarely required^{21,22}. In our study we had bile leak in 4 patients and bile leak with dropped stone in 2 cases leading to difficult LC. However none of these patients were converted to OC. This finding is consistent with others.

CONCLUSION

1. Difficulty in laparoscopic cholecystectomy was seen below and above 50 years age groups; however the conversion rate was higher in above 50 years.
2. BMI greater than 30 kg/m² (overweight patient) had higher chances of difficult laparoscopic cholecystectomy and conversion is also more in this group as compared to normal weight patient.
3. Ultrasonographic finding of thickened GB wall greater than 3 mm, multiple stones and stone impacted in Hartmann's pouch are factor responsible for difficult LC.
4. Perforation of gall bladder during surgery with bile leak and or dropped stone leads to difficult LC

Conflicts of interest: None

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