

# Evaluation of the Role of Various Factors in Conversion of Laparoscopic Cholecystectomy into Open Cholecystectomy

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## ABSTRACT

**Introduction:** Nowadays, laparoscopic cholecystectomy is the gold standard for definitive management of symptomatic gallstone disease. Although laparoscopic cholecystectomy can be successfully performed in most of the cases but there remains a significant number of patients who require conversion to open cholecystectomy. So present study was done to evaluate the role of various factors in predicting conversion of laparoscopic cholecystectomy to open cholecystectomy.

**Material and Methods:** The present study was conducted on 30 patients of gallstone disease admitted for cholecystectomy in whom laparoscopic cholecystectomy was attempted. All the patients were selected at random. The patients, with suspected CBD stones or dilated CBD on ultrasonography and patients in whom laparoscopic cholecystectomy could not be performed due to various medical reasons like CHF, CAD, COPD, uncontrolled hypertension and uncontrolled diabetes, were excluded from the study. The patients having clinical or USG diagnosis of suspected carcinoma gallbladder were also not included.

**Results:** In the present study, total 6 patients (out of 30) were converted into open cholecystectomy. Out of six, 5 had dense adhesions with obscure anatomy in Calot's triangle and 1 had sessile gallbladder. In one case of adhesions, which was converted, there was also a technical failure during the procedure (problem with CO<sub>2</sub> insufflator).

**Conclusion:** It was concluded that increased gallbladder wall thickness on ultrasound and acute cholecystitis are the factors predicting conversion from laparoscopic cholecystectomy to open cholecystectomy. Intra-operatively, dense adhesions and obscure Calot's triangle are the most important factors predicting conversion. Finally, it is emphasised that conversion of laparoscopic cholecystectomy to open cholecystectomy reflects sound surgical judgement; it should not be considered as a complication of the procedure.

**Keywords:** Adhesions, Calot's Triangle, Cholecystitis, Cholelithiasis, CO<sub>2</sub> Insufflator, Laparoscopic Cholecystectomy, Open Cholecystectomy, Sessile Gallbladder.

## INTRODUCTION

Gallstones are remarkably common and are a major and expensive health problem. During the last few centuries numerous innovative and creative techniques have been introduced in an effort to manage patients with symptomatic gallstones but the treatment remained relatively primitive and ineffective until late 1800s when Langenbuch performed the first successful cholecystectomy on 15<sup>th</sup> of July, 1882 in Berlin.<sup>1</sup> Since then cholecystectomy has remained the gold standard for definitive management of symptomatic gallstone disease.<sup>2</sup>

The first laparoscopic cholecystectomy was performed by Muhe in 1985.<sup>3</sup> However the first laparoscopic cholecystectomy recorded in the medical literature was performed in March 1987 by Mauret, in Lyon, France.<sup>4</sup> The technique was perfected a year

later, in March, 1988 by Dubois in Paris<sup>5</sup> and later that year by Perriset in Bordeaux, France<sup>6</sup> and by Reddick in Nashville, Tennessee.<sup>7</sup> Within five years, laparoscopic cholecystectomy surpassed conventional cholecystectomy as the procedure of choice for diseases of the gallbladder.

Although laparoscopic cholecystectomy can be successfully performed in most of the cases but there remains a significant number of patients who require conversion to open cholecystectomy.<sup>8</sup> Conversion to open cholecystectomy is necessary in upto 5% of the patients undergoing elective cholecystectomy and in upto 30% of patients undergoing laparoscopic cholecystectomy for acute cholecystitis.<sup>9</sup>

Old age, male sex, obesity, raised WBC count, thickened gallbladder wall in pre-operative USG, acute cholecystitis, previous abdominal surgery and presence of CBD stone have been reported as important predictors for conversion of laparoscopic cholecystectomy into open cholecystectomy. Study was done with the aim to evaluate the role of various factors in predicting conversion of laparoscopic cholecystectomy to open cholecystectomy

## MATERIAL AND METHODS

The present study was conducted on 30 patients of gallbladder disease, who were selected on the basis of history and clinical examination and confirmed by ultrasound abdomen, admitted for cholecystectomy in whom laparoscopic cholecystectomy was attempted. All the patients were selected at random.

### Exclusion criteria

1. The patients with suspected CBD stones or dilated CBD on ultrasonography were excluded from the study.
2. The patients having clinical or USG diagnosis of suspected carcinoma gallbladder were not included.
3. The patients in whom laparoscopic cholecystectomy could not be performed due to various medical reasons like CHF, CAD, COPD, uncontrolled hypertension and uncontrolled diabetes were excluded from the study.

Detailed history of each patient was taken with special emphasis on age, sex, height, weight, symptoms of abdominal pain, nausea, vomiting, history of jaundice or pancreatitis and previous abdominal surgery. The mode of admission was

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also noted, distinguishing between elective and emergency admissions.

Thorough general physical, abdominal and systemic examination was carried out in all the patients. Routine investigations e.g. Hb, BT, CT, FBS, Blood Urea, Serum Creatinine, urine complete examination, WBC Count and ECG were done in all cases. Liver function tests like serum bilirubin, alkaline phosphatase, SGOT and SGPT were also carried out.

**Special investigations**

Pre-operative ultrasonography was done in all the cases with special emphasis on gallbladder size, wall thickness, presence of single or multiple stones in the gallbladder and the condition of biliary passages, pancreas and liver.

**Operative procedure**

The operative procedure was performed under general anaesthesia in all the cases. Laparoscopic cholecystectomy was attempted in all the cases. In some of the cases, conversion to open cholecystectomy was required and the factors responsible for conversion were identified. The results were statistically analysed. The time duration of surgery was also recorded.

**STATISTICAL ANALYSIS**

Unpaired t test and chi square test were applied to find statistical significance of the results.

**RESULTS**

The present study was conducted to evaluate the factors predicting conversion of laparoscopic cholecystectomy into open cholecystectomy. The study was conducted on 30 patients. All patients underwent clinical examination, relevant haematological and biochemical investigations and ultrasonographic investigation of hepatobiliary tract. Laparoscopic cholecystectomy was attempted in all the patients. Some of the patients required conversion to open cholecystectomy. The observations thus made were analyzed and recorded as follows:

**Age distribution**

Age of presentation of gallstone disease in this study varied from 20-80 years. Most of the cases were in 5<sup>th</sup> decade of life. This age group accounted for 53.33% of the patients followed by five patients (16.67%) who presented in 4<sup>th</sup> decade of life. The youngest patient in this study was 22 years old and oldest patient was of 73 years. The mean age of patients in this study was 43.80 ± 11.05 years.

**Comparison of age in patients undergoing conversion and successful laparoscopic cholecystectomy**

The mean age of patients undergoing conversion was higher (48.0±7.89 years) than patients undergoing successful laparoscopic cholecystectomy (42.87±11.62). However, this difference was not statistically significant.

**Sex distribution**

Majority of the patients in this study were females (90%).

Percentage of males in the study was 10%. The ratio of female to male patients in this study was 9: 1.

**Sex as a factor of conversion from laparoscopic cholecystectomy to open cholecystectomy**

The conversion rate in male patients in this study was 33.33% as compared to 18.18% in case of female patients. This difference was found to be statistically non significant.

**Symptoms**

In this study, majority of the patients presented with pain abdomen (96.66%) followed by dyspepsia (70%), fever (30%), vomiting (23.33%) and jaundice (3.33%).

**History of previous abdominal surgery**

Six patients (20%) in this study had previous lower abdominal surgery. Twenty four patients (80%) had no history of previous abdominal surgery.

**Previous abdominal surgery in patients undergoing conversion and successful laparoscopic cholecystectomy**

Six patients (20%) in their study had previous lower abdominal surgery. Out of these six patients, two patients (33.33%) underwent conversion. In 24 patients who had no history of previous abdominal surgery, 4 cases were converted (16.67%). The results were found to be statistically insignificant.

**Conversion in cases of acute cholecystitis (Table 1)**

Table 1 show that in the present study, the conversion rates in patients with acute cholecystitis was found to be highest 44.44% whereas the conversion rate in patients with no symptoms/signs of acute cholecystitis was only 9.52%. However, all these patients were operated upon in the next routine operation theatre thereby causing delay in surgery. The results were found to be statistically significant.

**Total leucocyte count (TLC)**

There were 21 patients (70%) in the study with normal TLC and 9 patients (30%) with increased TLC. The maximum TLC was 13,500 and minimum TLC was 4200 in the study. All the cases with increased TLC had acute cholecystitis.

**Comparison of TLC of patients undergoing conversion and successful laparoscopic cholecystectomy**

The patients undergoing conversion had mean TLC of 12,666.67±816.49 which was much greater than mean TLC of patients who underwent successful laparoscopic cholecystectomy (9056.25±1443.90). This difference was found to be statistically significant (P <0.001).

**Comparison of DLC (% of neutrophils) of patients undergoing conversion and successful laparoscopic cholecystectomy**

The patients who underwent conversion had mean DLC count (%age of neutrophils) 85.0±2.75 which was greater than mean DLC count (%age of neutrophils) of patients who underwent successful laparoscopic cholecystectomy (70.59±9.49). This difference was found to be statistically significant (P <0.01). All

Diagnosis	No.	Conversion		X <sup>2</sup>	P value
		No.	%Age		
Acute cholecystitis	9	4	44.44%	5.384	<0.02, Significant
Acute cholecystitis absent	21	2	9.52%		

**Table-1:** conversion in cases of acute cholecystitis

the patients in this study who had increased DLC count were cases of acute cholecystitis.

### Comparison of gallbladder wall thickness (in mm) in patients undergoing conversion and successful laparoscopic cholecystectomy (Table 2)

TABLE 2 shows that the patients undergoing conversion had a mean gallbladder wall thickness of  $3.76 \pm 0.49$  mm which was greater than mean gallbladder wall thickness of patients who underwent successful laparoscopic cholecystectomy ( $2.60 \pm 0.36$ ). This difference was found to be statistically significant ( $P < 0.001$ ).

### Number of stones as a factor for conversion

The conversion rate, in patients with a single stone and multiple stones, was found to be similar (20%).

### Diameter of largest stone (in mm) as a factor of conversion

The conversion rate in patients with diameter of largest stone  $> 20$  mm in this study was 33.33% as compared to 18.18% in cases with diameter of largest stone  $\leq 20$  mm. This difference was found to be statistically non-significant.

### Comparison of intra-operative reasons causing difficulty in laparoscopic cholecystectomy and conversion of laparoscopic cholecystectomy to open cholecystectomy (Table 3)

Table 3 shows that intra-operatively, dense adhesions were found to be statistically significant reason for conversion to open cholecystectomy. Out of 8 patients with dense adhesions, 5 patients (62.5%) required conversion to open cholecystectomy. Obscure anatomy in Calot's triangle, sessile gallbladder and technical failure were clinically significant reasons for conversion.

### Duration of surgery (in minutes)

In sixteen patients (53.33%), the operation time was less than 60 minutes. In 12 patients (40%) the duration of surgery was between 61 and 120 minutes whereas 2 patients (6.66%) required between 121-180 minutes for surgery. All the cases requiring conversion to open cholecystectomy had duration of

surgery more than 60 minutes with 5 cases (83.33%) having duration between 61 and 120 minutes and one case (16.67%) having duration between 121 and 180 minutes. The minimum operative time in our study was 25 minutes and maximum time was 170 minutes.

### Comparison of hospital stays in conversion and successful laparoscopic cholecystectomy patients

The patients undergoing conversion had mean hospital stay of  $9.50 \pm 1.37$  days which was much greater than mean hospital stay of patients who underwent successfully completed laparoscopic cholecystectomy ( $3.29 \pm 1.23$  days). This difference in hospital stay was found to be statistically highly significant.

## DISCUSSION

Although laparoscopic cholecystectomy can be performed successfully in majority of the patients, there remains a significant number of patients who require conversion to open cholecystectomy. Conversion patients involve not only extra time and cost; but also there is more analgesic requirement and longer hospital stay, longer recovery time and more post-operative complications.<sup>10</sup>

In the present study, total 6 patients (out of 30) were converted into open cholecystectomy. Out of six, 5 had dense adhesions with obscure anatomy in Calot's triangle and 1 had sessile gallbladder. In one case of adhesions, which was converted, there was also a technical failure during the procedure (problem with CO<sub>2</sub> insufflator). Out of these, 4 had acute cholecystitis and 2 underwent elective cholecystectomy.

### Age

Incidence of gallstone disease increases with age. A classical gallbladder stone patient has been described as 'fat, fertile female in forties and fifties'.

In our study the mean age of patients presenting with gallstone disease was  $43.80 \pm 11.05$  years. The results showed that age did not significantly affect the risk of conversion in cases of laparoscopic cholecystectomy.

Group	No.	Wall thickness (in mm) range	Mean $\pm$ sd	Difference	T	P	S
Conversion	6	3-4.5	$3.76 \pm 0.49$	1.16	6.51	$< 0.001$	S
Successful	24	2-3.2	$2.60 \pm 0.36$				

**Table-2:** Comparison of gallbladder wall thickness (in mm) in patients undergoing conversion and successful laparoscopic cholecystectomy

Reasons of conversion	Successful		Conversion		P values
	N=24	%Age	N=6	%Age	
Dense adhesions	3	37.5	5	62.5%	$X^2 = 12.885$ $P < 0.01$ Significant
Thick walled gallbladder	4	57.15	3	42.85%	$X^2 = 3.311$ $P > 0.05$ Non significant
Obscure anatomy in calot's triangle	-	-	5	100%	Clinically significant
Sessile gallbladder	-	-	1	100%	Clinically significant
Technical failure	-	-	1	100%	Clinically significant

\*Total 6 patients out of 30 were converted to open cholecystectomy, 5 had dense adhesions with obscure anatomy in calot's triangle, 1 had sessile gallbladder. In one case of adhesions which was converted there was also a technical failure during the procedure (problem with co<sub>2</sub> insufflator). \*\*The discrepancy in the total was due to overlapping of intra-operative findings.

**Table-3:** Comparison of intra-operative reasons causing difficulty in laparoscopic cholecystectomy and conversion of laparoscopic cholecystectomy to open cholecystectomy



Similarly, Alponat et al (1997)<sup>11</sup> in a retrospective study of 783 patients which included 668 patients with age  $\geq 65$  years reported age as statistically non-significant predictor for conversion. However, Maxwell et al (1998)<sup>12</sup>, reported increased risk of conversion in patients who were more than 80 years of age. The study suggested that biliary disease in the elderly is a more advanced process.

#### Sex

Gallbladder stones are more commonly seen in females with M: F ratio being 2:1.<sup>13</sup>

In our study also, the ratio of females to males was high i.e. 9: 1.

#### History of previous abdominal surgery

In our study, the conversion rate in patients with history of previous abdominal surgery was 33.33% as compared to conversion rate of 16.67% in patients with no history of abdominal surgery. However, these results were found to be statistically non-significant.

Similarly, Liu et al, 1996<sup>14</sup> concluded that history of previous lower abdominal surgery did not lead to increased risk of conversion.

#### Acute cholecystitis

The conversion rate in cases of acute cholecystitis in the present study was 44.44% as compared to 9.52% in cases in whom acute cholecystitis was absent. This difference was found to be statistically significant. The conversion rate in cases of acute cholecystitis in the present study was partly due to the fact that some of these patients were operated upon in the next routine OT list resulting in considerable delay.

Similarly, Liguori et al (2003)<sup>15</sup> while studying patients with acute cholecystitis found conversion rate of 15% in early operations and 23.8% in operations delayed for more than 72 hours.

#### WBC Count (TLC, DLC)

In the present study, it was found that increased TLC and DLC (%age of neutrophils) were significant factors for predicting conversion of open into laparoscopic cholecystectomy. However, all the patients with raised TLC and DLC had acute cholecystitis which was the probable cause of conversion. Similarly, Rosen et al (2002)<sup>16</sup> reported that WBC count of  $>9 \times 10^3/\text{mm}^3$  predicted conversion to open cholecystectomy.

#### Gallbladder wall thickness

In the present study the mean gallbladder wall thickness in patients who underwent conversion was  $3.76 \pm 0.49$  mm and in patients who underwent successful laparoscopic cholecystectomy, it was  $2.60 \pm 0.36$  mm. This difference was found to be statistically significant.

Similarly, Jansen et al (1997)<sup>17</sup> in series of 738 patients reported gallbladder wall thickness of more than 4mm as a high risk factor for conversion.

The difficult cholecystectomy in a thick walled gallbladder may be due to difficulty in maintaining the grip on the gallbladder or the gallbladder may be immersed in the gallbladder bed or the cystic duct may be short. So, the grip can be improved by using a toothed grasper.

#### Number of stones

In this study, the number of stones was not found to be significant predictor of conversion. Similar observations have

been reported by Carmody et al (1994).<sup>18</sup>

#### Diameter of largest stone

The conversion rate in patients with diameter of largest stone  $\geq 20$ mm was 33.33% as compared to 18.18% in patients with diameter of largest stone  $\leq 20$ mm. However, this difference was not statistically significant. Similar observations were reported by Mcloughin et al (1992).<sup>19</sup>

#### Intra-operative findings

Intra-operatively dense adhesions which were difficult to lyse was the significant factor leading to conversion in 5 cases of this study. Obscure anatomy in Calot's triangle was also the reason of conversion in these 5 patients. Adhesions of gallbladder may be due to the omentum, stomach, duodenum or colon.

Fried et al (1994)<sup>20</sup>, in their study also reported significant association between these intra-operative findings and conversion to open.

#### Duration of surgery (in minutes)

The time taken for surgery in this study varied from 25 minutes to 170 minutes. The maximum time taken was 170 minutes. In this patient, dense adhesions were present and it was very difficult to dissect them. This case had to be ultimately converted into open cholecystectomy. The minimum time taken for surgery was 25 minutes. 53.33% of the patients in the present study had operation time less than 60 minutes. However, 40% cases had operation time between 61-120 minutes. This may be due to inclusion of cases of acute cholecystitis in the present study.

Similarly, Ligouri et al (2003)<sup>15</sup> studied 50 cases of acute cholecystitis and reported 120 minutes as the mean operative time.

#### CONCLUSION

This study was carried out on 30 patients who were planned for laparoscopic cholecystectomy. In the present study, total 6 patients (out of 30) were converted into open cholecystectomy. Out of six, 5 had dense adhesions with obscure anatomy in Calot's triangle and 1 had sessile gallbladder. In one case of adhesions, which was converted, there was also a technical failure during the procedure (problem with CO<sub>2</sub> insufflator). Out of these, 4 had acute cholecystitis and 2 underwent elective cholecystectomy.

So, it is concluded that increased gallbladder wall thickness on ultrasound and acute cholecystitis are the factors predicting conversion from laparoscopic cholecystectomy to open cholecystectomy. Intra-operatively, dense adhesions and obscure Calot's triangle are the most important factors predicting conversion. Finally, it is emphasised that conversion of laparoscopic cholecystectomy to open cholecystectomy reflects sound surgical judgement; it should not be considered as a complication of the procedure.

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