



Original Research

Predictive Factors Associated with Conversion of Laparoscopic Cholecystectomy to Open Cholecystectomy

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Name of Author:

Muhammad Imran¹, Muhammad Nadeem Aslam², Abdul Basit Qureshi³, Javeria Arshad⁴, Hafiz Inamullah⁵, Amna⁶

Affiliation: ^{1,5}Postgraduate Resident, Surgical Unit 1, Services Hospital, Lahore, Pakistan

²Professor, Surgical Unit I, Services Hospital, Lahore, Pakistan

³Professor, Surgical Unit II, Services Hospital, Lahore, Pakistan

⁴Senior Registrar, Surgical Unit I, Services Hospital, Lahore, Pakistan

⁶House Surgeon, Surgical Unit I, Services Hospital, Lahore, Pakistan

Corresponding Author:

Dr. Muhammad Imran

Email: dr.imrankharal@gmail.com

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Abstract: **Background:** Laparoscopic cholecystectomy is the preferred treatment for symptomatic gallstone disease, however conversion to open surgery may be required in patients with difficult operative findings. **Objective:** To determine the frequency and factors associated with conversion from laparoscopic to open cholecystectomy. **Methodology:** A prospective observational study was conducted among 75 patients aged 20–70 years undergoing laparoscopic cholecystectomy for symptomatic gallstone disease at Unit I, Department of Surgery, Services Hospital Lahore for the duration from April 2025 to October 2025. Demographic, clinical, ultrasonographic, and operative findings were recorded. Data were analyzed using SPSS version 25. Chi-square and independent-samples t-test were used. A p-value ≤ 0.05 was considered statistically significant. **Results:** Of 75 patients, 12 (16.0%) required conversion to open cholecystectomy, while 63 (84.0%) underwent successful laparoscopic surgery. ASA III/IV status was significantly more frequent among patients requiring conversion than those with successful laparoscopic surgery (41.7% vs. 9.5%). Dense adhesions or frozen Calot's triangle were also significantly more common in the conversion group (66.7% vs. 15.9%). Gallbladder perforation occurred in 16.7% of converted patients compared with 3.2% of successful cases. Mean gallbladder wall thickness was significantly greater among patients requiring conversion (0.54 ± 0.12 cm vs. 0.40 ± 0.11 cm, $p=0.002$). Conversion to open cholecystectomy occurred in 16.0% of patients. **Conclusion:** Higher ASA status, dense adhesions or frozen Calot's triangle, gallbladder perforation, and greater gallbladder wall thickness was associated with conversion. Careful preoperative assessment may help identify patients at increased risk and facilitate appropriate surgical planning and patient counselling.

Keywords: Laparoscopic Cholecystectomy, Dense Adhesions, Frozen Calot, Gall bladder

INTRODUCTION

Worldwide, gallstones are common with a prevalence of 10-15% in the developed world and 16% in Pakistan. Risk factors for this condition are either genetic or environmental and lifestyle factors such as obesity and metabolic disease play a big role. Symptomatic gallstones can lead to complications hence usually prompt treatment, which is most often surgical needed.¹ Laparoscopic Cholecystectomy (LC) is the most common minimally invasive procedure in general surgery and the preferred method of surgical intervention in patients with cholelithiasis due to shorter hospital stay time, fewer complications

and improved cosmesis.² Open Cholecystectomy is preferred where laparoscopic cholecystectomy is not available or if there is significant risk of iatrogenic injury especially to the common bile duct from laparoscopic cholecystectomy.^{2, 3} Both of these are safe in their own right but conversion from laparoscopic to open cholecystectomy can lead to injury, post-operative complications and a longer hospital stay. The rate of conversion ranges from 4.6-20%.^{4,5}

The reported frequency of conversion from LC to OC varies between populations and surgical settings. A

systematic review of 35 studies reported an overall conversion rate of approximately 5.9%, although substantial variation was observed among individual studies.⁶ The identification of predictive factors before and during surgery is therefore important for appropriate operative planning and patient counselling. In a prospective study from Pakistan involving 1,081 laparoscopic cholecystectomies, conversion to open surgery occurred in 7.78% of cases. Older age (≥ 65 years), morbid obesity, diabetes mellitus, previous abdominal surgery, increased gallbladder adhesions, empyema, perforation, and scleroatrophic gallbladder were associated with a higher risk of conversion.⁷ A recent retrospective cohort study from Iraq reported a 9.2% conversion rate from laparoscopic to open cholecystectomy among 945 patients undergoing laparoscopic cholecystectomy. Male sex, previous abdominal surgery, and higher ASA class were identified as independent preoperative predictors of conversion. The most frequent intraoperative reasons included difficult dissection associated with a distended or thick-walled gallbladder, severe inflammation with gallbladder neck stones, and dense adhesions from previous surgery.⁸

Although several international studies have investigated risk factors associated with conversion, the magnitude and pattern of these factors may vary according to patient characteristics, referral patterns, disease presentation and surgical expertise. Local data are therefore important for identifying commonly encountered factors in our clinical setting. Early recognition of patients at increased risk of difficult laparoscopic cholecystectomy may assist in appropriate preoperative counselling, surgical planning and allocation of operative resources. Therefore, the present study is planned to determine the frequency of selected patient-related, clinical and operative factors associated with conversion of laparoscopic cholecystectomy to open cholecystectomy in patients undergoing laparoscopic cholecystectomy at Services Hospital Lahore.

MATERIALS AND METHODS

A prospective observational study was conducted in Unit I, Department of Surgery, Services Hospital Lahore, for the duration from April 2025 to October 2025. The study was including patients aged 20–70 years of either gender who were planned to undergo laparoscopic cholecystectomy for symptomatic gallstone disease. A sample size of 75 patients was included using the previously calculated sample size

based on a 95% confidence level, 7% margin of error and an estimated frequency of perforated gallbladder of 10.5% as reported in previous literature.

Patients with recurrent gallbladder disease, renal dysfunction with serum creatinine >2.0 mg/dL, deranged coagulation profile with PT >15 seconds or INR >1.5 , pregnancy, gallbladder carcinoma, or those undergoing another major surgical procedure simultaneously were excluded. Written informed consent was obtained from all eligible participants before enrollment. Demographic and clinical information was collected using a structured data collection proforma. Variables including age, gender, body mass index (BMI), smoking history, alcohol use, hypertension and diabetes mellitus was recorded. Preoperative ultrasonographic findings, particularly gallbladder wall thickness, was also documented. During laparoscopic cholecystectomy, operative findings including dense adhesions or frozen Calot's triangle, intrahepatic or buried gallbladder and gallbladder perforation was recorded.

The primary outcome was conversion of laparoscopic cholecystectomy to open cholecystectomy. Conversion was defined as inability to safely complete the laparoscopic procedure, requiring an open surgical approach during the same operation. Obesity was defined as BMI >30 kg/m², ASA III/IV as an ASA physical status of III or IV, dense adhesions as severe adhesions associated with inflammation or frozen Calot's triangle, intrahepatic or buried gallbladder as a gallbladder that is partially or completely buried within the liver and difficult to visualize, perforated gallbladder as an intraoperative gallbladder perforation, and thickened gallbladder wall as wall thickness >0.4 cm on ultrasonography.

All collected data was entered and analyzed using SPSS version 25. Quantitative variables including age, BMI and gallbladder wall thickness were presented as mean $\pm$ standard deviation. Categorical variables including gender, smoking, alcohol use, hypertension, diabetes, obesity, ASA status, dense adhesions, intrahepatic or buried gallbladder, gallbladder perforation and thickened gallbladder wall were presented as frequencies and percentages. In the final comparative analysis, patients with successful laparoscopic cholecystectomy were compared with those requiring conversion to open surgery using the Chi-square test or Fisher's exact test for categorical variables and independent-samples t-test. A p-value ≤ 0.05 was considered statistically significant.

RESULT

Total 75 patients included in the study. Among these, 12 (16.0%) patients required conversion from laparoscopic to open cholecystectomy, while 63 (84.0%) underwent successful laparoscopic cholecystectomy. Fig: 1 The mean age of the patients was 48.2 ± 11.8 years. The mean BMI was 27.9 ± 4.6 kg/m².

Among the patients who required conversion to open surgery, the mean age was 51.1 ± 11.9 years compared with 47.6 ± 11.7 years among patients with successful laparoscopic cholecystectomy. Male patients constituted 8 (66.7%) of the conversion group compared with 27 (42.9%) of the successful laparoscopic group. Obesity was present in 5 (41.7%) patients in the conversion group compared with 18 (28.6%) patients in the successful laparoscopic group. All demographic variables were insignificant with conversion group and successful laparoscopic group ($p > 0.05$). Table: 1

ASA physical status III or IV was significantly more common among patients requiring conversion than among those who underwent successful laparoscopic cholecystectomy 5 (41.7%) vs. 6 (9.5%). Dense adhesions associated with severe inflammation or a frozen Calot's triangle were also significantly more frequent in the conversion group 8 (66.7%) vs. 10 (15.9%). An intrahepatic or buried gallbladder was identified in 3 (25.0%) patients in the conversion group compared with 4 (6.3%) in the successful laparoscopic group. While gallbladder perforation was observed in 2 (16.7%) and 2 (3.2%) patients, respectively ($p = 0.118$). The mean gallbladder wall thickness was significantly higher in patients requiring conversion than in those with successful laparoscopic surgery 0.54 ± 0.12 cm vs. 0.40 ± 0.11 cm.

Overall, among the evaluated factors, dense adhesions/frozen Calot's triangle, ASA III/IV status, and thickened gallbladder wall were more frequently observed among patients requiring conversion to open surgery. These findings suggest that difficult operative anatomy and markers of more severe gallbladder disease may be associated with conversion from laparoscopic to open cholecystectomy. Table: 2.

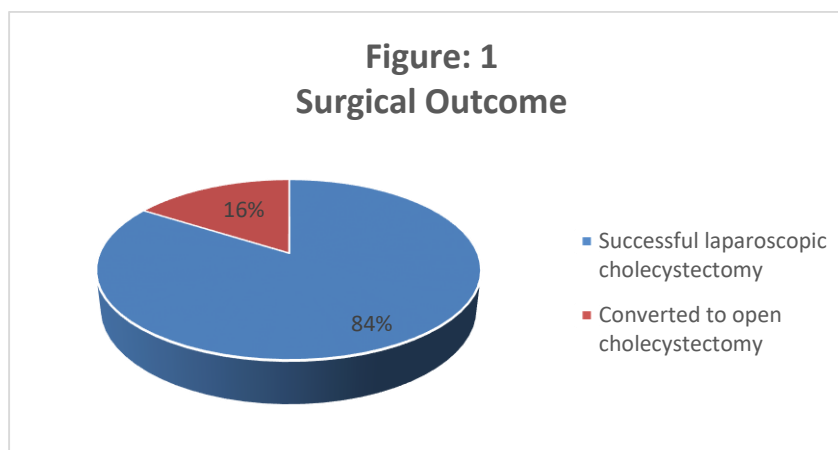


Table: 1 Demographic Characteristics of patients

	Total n=75	Conversion n=12	Successful LC n=63	
Age, years	48.2 ± 11.8	51.1 ± 11.9	47.6 ± 11.7	0.364
Male	35 (46.7%)	8 (66.7%)	27 (42.9%)	0.482
Female	40 (53.3%)	4 (33.3%)	36 (57.1%)	
BMI, kg/m ²	27.9 ± 4.6	28.8 ± 4.9	27.7 ± 4.5	0.206
Obesity (BMI >30)	23 (30.7%)	5 (41.7%)	18 (28.6%)	0.496
Smoking >5 pack-years	11 (14.7%)	3 (25.0%)	8 (12.7%)	0.36
Alcohol use	4 (5.3%)	1 (8.3%)	3 (4.8%)	0.510
Hypertension	19 (25.3%)	4 (33.3%)	15 (23.8%)	0.48
Diabetes mellitus	18 (24.0%)	4 (33.3%)	14 (22.2%)	0.46

Table: 2 Preoperative and operative factors

Factor	Conversion n=12	Successful LC n=63	P value
ASA III/IV	5 (41.7%)	6 (9.5%)	0.012
ASA I/II	7 (58.3%)	57 (90.5%)	
Dense adhesions/frozen Calot's triangle	8 (66.7%)	10 (15.9%)	0.001
Intrahepatic/buried gallbladder	3 (25.0%)	4 (6.3%)	0.07
Perforated gallbladder	2 (16.7%)	2 (3.2%)	0.011
Thickened gallbladder wall >0.4 cm	9 (75.0%)	27 (42.9%)	0.059
Gallbladder wall thickness (cm)	0.54 ± 0.12	0.40 ± 0.11	0.002

DISCUSSION

Conversion from laparoscopic to open cholecystectomy remains an important outcome in patients undergoing laparoscopic cholecystectomy, particularly in those with difficult operative anatomy and advanced inflammatory changes. In the present study, 12 (16.0%) of 75 patients required conversion to open surgery, while 63 (84.0%) underwent successful laparoscopic cholecystectomy. The conversion rate observed in our study was higher than the pooled rate of 5.9% reported in a systematic review of 30 studies involving 92,765 laparoscopic cholecystectomies.⁶ However, conversion rates vary considerably between institutions according to patient selection, disease severity, surgeon experience, and the proportion of difficult or inflamed gallbladders included in the study population. Chin et al. reported conversion rates ranging from 2.5% to 50% across the included studies, highlighting this variability.⁹

In the present study, ASA physical status III or IV was significantly more frequent among patients requiring conversion than among those undergoing successful laparoscopic surgery 41.7% vs. 9.5%. This finding suggests that patients with greater systemic disease burden may be more likely to have a difficult operative course. A higher ASA class may reflect the presence of multiple comorbidities and reduced physiological reserve, which can coexist with more complicated gallbladder disease. Previous literature has also identified higher ASA status as an important predictor of conversion. In a study evaluating predictors of conversion, ASA greater than II was associated with conversion among patients undergoing nonelective cholecystectomy.¹⁰ More recently, a five-year cohort study from Iraq also identified ASA class III as an independent preoperative predictor of conversion, with an adjusted odds ratio of 1.80 ($p=0.049$). The consistency of these findings supports the importance of considering the patient's overall physical status during preoperative assessment.¹¹

Dense adhesions associated with severe inflammation or a frozen Calot's triangle were the most frequent operative finding in the conversion group in our study. They were present in 8 (66.7%) patients requiring conversion compared with 10 (15.9%) patients with successful laparoscopic surgery, and this difference was statistically significant ($p<0.001$). In such circumstances, continued laparoscopic dissection may increase the risk of bile duct or vascular injury, and conversion can provide safer access and better exposure. This finding is consistent with Krishna et al., conducted a study in India and found that most common factor that causes conversion to open surgery was dense adhesions due to severe tissue inflammation/frozen Calot's triangle (71%), followed by buried / intrahepatic gallbladder (15.7%), perforated gallbladder (10.5%) and thickened

gallbladder wall (15.7%).¹⁰ A recent Pakistani study also reported dense adhesions as a significant factor associated with conversion to open surgery.¹²

Gallbladder wall thickness was another important finding in our study. The mean wall thickness was significantly higher among patients who required conversion compared with those who underwent successful laparoscopic surgery (0.54 ± 0.12 cm vs. 0.40 ± 0.11 cm, $p=0.002$). The difference in the continuous measurement suggests that increasing wall thickness may provide useful information even when a predefined cutoff does not show statistical significance in a relatively small sample. Previous studies have consistently described increased gallbladder wall thickness as a predictor of difficult laparoscopic cholecystectomy.¹³ A systematic review and meta-analysis found thickened gallbladder wall to be significantly associated with conversion, while another systematic review identified a wall thickness greater than 4–5 mm as a risk factor.¹⁴ A recent study also found gallbladder wall thickness to be an effective predictor of conversion, further supporting its potential value in preoperative ultrasound assessment.¹⁵

Intrahepatic or buried gallbladder was identified in 3 (25.0%) converted patients compared with 4 (6.3%) patients in the successful laparoscopic group; however, the difference was not statistically significant ($p=0.077$). Similarly, gallbladder perforation occurred in 16.7% of converted patients compared with 3.2% of successful laparoscopic cases, but this difference was not statistically significant ($p=0.118$). Nevertheless, these operative findings may have practical importance because an abnormal gallbladder position, perforation, or severe local inflammation can make exposure and safe dissection more difficult. In a large Pakistani cohort of 1,081 patients, increased adhesions, empyema, gallbladder perforation, and scleroatrophic gallbladder were significantly associated with conversion.^{7,16}

The demographic findings in our study showed a higher proportion of males in the conversion group than in the successful laparoscopic group (66.7% vs. 42.9%), although the difference was not statistically significant. This pattern is in agreement with larger studies in which male sex has been identified as a risk factor for conversion. A meta-analysis reported that male patients had approximately twice the odds of conversion compared with female patients (OR 1.91, 95% CI 1.25–2.90). Similarly, a recent Iraqi cohort found male sex to be an independent predictor of conversion (aOR 2.10, $p=0.002$). The absence of statistical significance in our study may be related to the relatively small sample size and the limited number of conversion events.¹¹

Overall, the findings of this study indicate that

conversion to open cholecystectomy is associated particularly with markers of difficult operative anatomy and greater disease or patient complexity. Dense adhesions and higher ASA status showed significant associations with conversion, while increased gallbladder wall thickness was also significantly higher among converted patients. These findings emphasize the importance of careful preoperative assessment and detailed ultrasonographic evaluation of the gallbladder. Identification of patients at increased risk may help surgeons anticipate technical difficulty, counsel patients regarding the possibility of conversion, and plan operative management appropriately. However, the relatively small sample size and limited number of conversion events should be considered when interpreting these findings, and larger prospective studies are needed to establish robust predictive models for conversion.

CONCLUSION

The conversion of the study from laparoscopic to open cholecystectomy was observed in 16.0% of patients in the present study. Higher ASA physical status, dense adhesions with severe inflammation or a frozen Calot's triangle, and greater gallbladder wall thickness were significantly associated with conversion. Intrahepatic or buried gallbladder and gallbladder perforation were more frequently observed among patients requiring conversion, although these associations did not reach statistical significance. Careful preoperative assessment of patient factors and gallbladder characteristics, along with anticipation of difficult operative anatomy, may help surgeons identify patients at increased risk of conversion and facilitate appropriate operative planning and patient counselling.

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