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**Research Article**

# Risk Factors Influencing Conversion from Laparoscopic to Open Cholecystectomy: A Retrospective Cohort Study from a Tertiary Care Hospital

**Dr. Sachin C A[1], Dr. Anil U S [2], Dr. Maheboob Pasha[2],**

*[1]Assistant Professor, Department of General Surgery, Sapthagiri Institute of Medical Sciences and Research Centre (SIMSRC), Chikkabanavara, Bengaluru, Karnataka, India*
*[2]Assistant Professor, Department of General Surgery, Sapthagiri Institute of Medical Sciences and Research Centre (SIMSRC), Chikkabanavara, Bengaluru, Karnataka, India*
*[3]Senior Resident, Department of General Surgery, Sapthagiri Institute of Medical Sciences and Research Centre (SIMSRC), Chikkabanavara, Bengaluru, Karnataka, India*
***Corresponding Author: Dr. Maheboob Pasha**, *Senior Resident, Department of General Surgery, Sapthagiri Institute of Medical Sciences and Research Centre (SIMSRC), Chikkabanavara, Bengaluru, Karnataka, India*

## ABSTRACT

**Background:** Laparoscopic cholecystectomy (LC) is the gold-standard treatment for symptomatic gallstone disease. Despite refinements in technique and instrumentation, a proportion of procedures still require conversion to open cholecystectomy (OC). Early identification of patients at higher risk of conversion facilitates informed consent, appropriate surgical planning, and optimal utilisation of theatre resources.

**Aims and Objectives:** To determine the incidence of conversion from LC to OC and to identify the preoperative and intraoperative risk factors independently associated with conversion at a tertiary care teaching hospital in South India.

**Materials and Methods:** A retrospective cohort study was conducted at the Department of General Surgery, Sapthagiri Institute of Medical Sciences and Research Centre, Bengaluru, over an approximately two-month period from 28 April 2026 to 30 June 2026. All consecutive adult patients (aged ≥ 18 years) undergoing LC for symptomatic gallstone disease during the study period were included. Demographic, clinical, biochemical, radiological and operative data were extracted from case records. Patients were stratified into two groups: those who underwent completed LC and those who required conversion to OC (LOC). Univariate comparison was made using the Chi-square test or Fisher's exact test for categorical variables and the independent samples t-test for continuous variables. Variables with $p < 0.10$ on univariate analysis were entered into a multivariate binary logistic regression model to identify independent predictors of conversion. A p-value $< 0.05$ was considered statistically significant.

**Results:** Of the 45 patients included, 8 (17.8%) required conversion from LC to OC. On

univariate analysis, age > 60 years (p = 0.006), male sex (p = 0.036), body mass index > 30 kg/m² (p = 0.019), acute cholecystitis at presentation (p = 0.005), duration of symptoms > 72 h (p = 0.003), leukocytosis (p = 0.019), gallbladder wall thickness > 4 mm on ultrasonography (p = 0.001), pericholecystic fluid (p = 0.004) and an impacted stone in the gallbladder neck (p = 0.001) were significantly associated with conversion. On multivariate logistic regression, gallbladder wall thickness > 4 mm (adjusted OR 8.7; 95% CI 1.8–42.1; p = 0.007), acute cholecystitis (adjusted OR 6.8; 95% CI 1.4–32.4; p = 0.017), impacted stone in the gallbladder neck (adjusted OR 5.9; 95% CI 1.2–28.4; p = 0.026), duration of symptoms > 72 h (adjusted OR 5.4; 95% CI 1.3–22.6; p = 0.021) and male sex (adjusted OR 4.2; 95% CI 1.1–16.5; p = 0.040) emerged as independent predictors of conversion. The most frequent intraoperative reason for conversion was dense adhesions with obscured anatomy at Calot's triangle (37.5%). Converted patients had a significantly longer operative duration and hospital stay, and a higher rate of postoperative morbidity.

**Conclusion:** The conversion rate of 17.8% observed in the present cohort is consistent with figures reported from other tertiary teaching hospitals. A thickened gallbladder wall on ultrasonography, acute cholecystitis, an impacted stone in the gallbladder neck, prolonged duration of symptoms and male sex were independent predictors of conversion. Preoperative recognition of these factors should form the basis of individualised risk assessment, counselling and operative planning.

**Keywords:** Laparoscopic cholecystectomy; Open cholecystectomy; Conversion; Risk factors; Gallbladder wall thickness; Acute cholecystitis; Tertiary care.

## INTRODUCTION

Symptomatic gallstone disease is one of the commonest surgical conditions encountered in general surgical practice, with an estimated prevalence of 10–15% in the adult population globally. Since its introduction by Philippe Mouret in 1987 and popularisation by Dubois and Perissat in the early 1990s, laparoscopic cholecystectomy (LC) has progressively replaced open cholecystectomy (OC) and is now regarded as the treatment of choice for symptomatic cholelithiasis, chronic calculous cholecystitis and non-complicated acute cholecystitis.

The advantages of LC over OC – smaller incisions, reduced postoperative pain, shorter hospital stay, earlier return to work, superior cosmesis and lower wound-related complications – are well documented in the literature. Despite these benefits, LC is not always feasible or safe to complete laparoscopically. In a proportion of patients, the procedure has to be converted to open surgery because of technical difficulty, unclear anatomy, intraoperative complications or safety concerns. Reported conversion rates range widely from 2% to 15% in elective settings and may exceed 30% in the setting of acute cholecystitis. Conversion, once considered a marker of surgical failure, is now understood to

represent sound surgical judgement aimed at preventing serious complications such as major bile duct injury or vascular injury.

Nevertheless, converted procedures are associated with a longer operative duration, longer hospital stay, higher morbidity and increased healthcare costs when compared with completed LC. Preoperative identification of patients at high risk of conversion is therefore clinically valuable: it enables informed consent, allows appropriate patient counselling, assists in planning the operative approach, and permits scheduling of the case with a senior surgeon and adequate theatre time.

A number of preoperative demographic, clinical, biochemical and radiological factors have been proposed as predictors of conversion in different populations. These include older age, male sex, obesity, previous upper abdominal surgery, diabetes mellitus, acute cholecystitis, prolonged duration of symptoms, leukocytosis, deranged liver function tests, a thickened gallbladder wall and pericholecystic fluid on ultrasonography, and an impacted stone in the gallbladder neck. However, the relative importance of these factors and their applicability to the local Indian population, particularly in the context of tertiary teaching hospitals where a greater proportion of complicated cases is encountered, remain to be adequately defined.

The present study was therefore undertaken with the aim of determining the rate of conversion from LC to OC and identifying the independent risk factors associated with conversion at a tertiary care teaching hospital in Bangalore, India.

# MATERIALS AND METHODS

***Study design and setting***

This was a hospital-based retrospective cohort study conducted in the Department of General Surgery, Sapthagiri Institute of Medical Sciences and Research Centre, Chikkabanavara, Bengaluru, Karnataka. The study period extended from 28 April 2026 to 30 June 2026 (a total of approximately two months, i.e., 64 days).

***Study population***

All consecutive adult patients (aged 18 years or above) who underwent LC for symptomatic gallstone disease during the study period were considered eligible for inclusion.

***Inclusion criteria:***

(i) Age ≥ 18 years; (ii) symptomatic cholelithiasis (biliary colic, chronic calculous cholecystitis or non-complicated acute cholecystitis); (iii) LC attempted through a standard four-port technique; and (iv) complete medical records available.

***Exclusion criteria:***

(i) Patients undergoing primary open cholecystectomy without an initial laparoscopic attempt; (ii) LC performed as part of a combined procedure (for example, along with common bile duct exploration, hepatectomy or gastric surgery); (iii) suspected or proven gallbladder malignancy; (iv) patients unfit for general anaesthesia; and (v) incomplete records.

***Definition of conversion***

Conversion was defined as the abandonment of the laparoscopic approach and completion of the cholecystectomy through a formal open

incision (right subcostal or midline). The reason for conversion, as documented in the operative notes, was recorded for each patient.

***Data collection***

A pre-designed structured proforma was used to extract data from case records, the operation theatre register and the hospital electronic medical record system. The following variables were recorded: demographic characteristics (age, sex, body mass index [BMI]); comorbidities (diabetes mellitus, hypertension, ischaemic heart disease); history of previous abdominal surgery; American Society of Anesthesiologists (ASA) physical status classification; clinical parameters (indication for surgery, duration of symptoms, number of previous attacks of biliary colic); laboratory investigations (total leukocyte count, serum bilirubin, alkaline phosphatase, alanine aminotransferase); preoperative ultrasonographic findings (gallbladder wall thickness, presence of pericholecystic fluid, impaction of stone at the neck of the gallbladder, common bile duct diameter); operative details (duration of surgery, reason for conversion where applicable, intraoperative complications); and postoperative outcomes (duration of hospital stay, wound infection, bile leak, mortality).

***Operative technique***

All laparoscopic cholecystectomies were performed under general anaesthesia using a standard four-port technique. The pneumoperitoneum was created either by the open (Hasson) technique or by the closed (Veress needle) technique at the discretion of the operating surgeon, with a working pressure of 12–14 mmHg. Dissection of Calot's triangle was performed with the aim of achieving the "critical view of safety" as described by Strasberg before division of the cystic duct and cystic artery. All procedures were performed or directly supervised by consultant surgeons with a minimum of five years of laparoscopic experience.

***Sample size***

Since the study was designed as a time-bound audit of a defined approximately two-month period, all eligible consecutive patients undergoing LC during that period were included. Based on the average annual load of elective and emergency cholecystectomies at the institution, an anticipated sample size of 40–50 patients was projected, which was considered adequate for a descriptive analysis and for the identification of clinically important risk factors.

***Statistical analysis***

Data were entered into a Microsoft Excel spreadsheet and analysed using IBM SPSS Statistics for Windows, version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation and compared using the independent samples t-test. Categorical variables were expressed as frequencies and percentages and compared using the Chi-square test or Fisher's exact test, as appropriate. Variables that showed an association with conversion at $p < 0.10$ on univariate analysis were entered into a multivariate binary logistic regression model to identify independent predictors of conversion. Adjusted odds ratios (aOR) with 95% confidence intervals (CI) were computed. A p-

value < 0.05 was considered statistically significant for all tests.

## RESULTS

### *Baseline characteristics*

A total of 45 patients underwent LC at the study institution during the approximately two-month study period and were included in the analysis. Of these, 8 patients (17.8%) required conversion from LC to OC, while 37 patients (82.2%) had a successfully completed LC. The mean age of the cohort was 46.3 ± 12.7 years (range: 22–74 years), and 19 patients (42.2%) were male. The baseline demographic and clinical characteristics of the two groups are summarised in Table 1

.

**Table 1:** Baseline demographic and clinical characteristics of the study population (N = 45).

| Variable | Completed LC (n = 37) | Converted (LOC) (n = 8) | p-value |
|---|---|---|---|
| Age (years), mean ± SD | 43.8 ± 11.9 | 57.9 ± 10.4 | **0.003** |
| Age > 60 years, n (%) | 6 (16.2) | 5 (62.5) | **0.006** |
| Male sex, n (%) | 13 (35.1) | 6 (75.0) | **0.036** |
| BMI (kg/m²), mean ± SD | 25.1 ± 3.4 | 29.2 ± 4.1 | **0.007** |
| BMI > 30 kg/m², n (%) | 5 (13.5) | 4 (50.0) | **0.019** |
| Diabetes mellitus, n (%) | 7 (18.9) | 4 (50.0) | 0.062 |
| Hypertension, n (%) | 10 (27.0) | 4 (50.0) | 0.222 |
| Previous abdominal surgery, n (%) | 4 (10.8) | 3 (37.5) | 0.056 |
| ASA grade III / IV, n (%) | 4 (10.8) | 3 (37.5) | 0.056 |

*LC = laparoscopic cholecystectomy; LOC = laparoscopic converted to open cholecystectomy; BMI = body mass index; ASA = American Society of Anesthesiologists; SD = standard deviation. Values in bold are statistically significant at p < 0.05.*

### *Clinical, laboratory and radiological profile*

The clinical presentation, biochemical parameters and preoperative ultrasonographic findings of the two groups are summarised in Table 2. Acute cholecystitis at presentation, a duration of symptoms greater than 72 hours, more than three previous attacks of biliary colic, a total leukocyte count greater than 11,000/mm³, a gallbladder wall thickness greater than 4 mm, the presence of pericholecystic fluid, and an impacted stone at the neck of the gallbladder were all significantly more frequent in the LOC group than in the completed LC group. The prevalence of these variables in the two groups is depicted in Figure 1.

**Table 2:** Clinical, laboratory and radiological parameters in the study population.

| Variable | Completed LC (n = 37) | Converted (LOC) (n = 8) | p-value |
|---|---|---|---|
| Acute cholecystitis, n (%) | 9 (24.3) | 6 (75.0) | **0.005** |
| Duration of symptoms > 72 h, n (%) | 8 (21.6) | 6 (75.0) | **0.003** |
| More than 3 previous attacks, n (%) | 6 (16.2) | 5 (62.5) | **0.006** |
| Total leukocyte count (×10³/mm³), mean ± SD | 8.4 ± 2.6 | 13.1 ± 3.2 | **< 0.001** |
| Leukocytosis (> 11,000/mm³), n (%) | 8 (21.6) | 5 (62.5) | **0.019** |
| Serum bilirubin (mg/dL), mean ± SD | 0.8 ± 0.3 | 1.2 ± 0.5 | **0.010** |
| Elevated alkaline phosphatase, n (%) | 5 (13.5) | 3 (37.5) | 0.098 |
| GB wall thickness > 4 mm on USG, n (%) | 7 (18.9) | 6 (75.0) | **0.001** |
| Pericholecystic fluid on USG, n (%) | 3 (8.1) | 4 (50.0) | **0.004** |
| Impacted stone in GB neck, n (%) | 4 (10.8) | 5 (62.5) | **0.001** |
| CBD diameter > 7 mm on USG, n (%) | 2 (5.4) | 2 (25.0) | 0.128 |

*LC = laparoscopic cholecystectomy; LOC = laparoscopic converted to open cholecystectomy; GB = gallbladder; USG = ultrasonography; CBD = common bile duct. Values in bold are statistically significant at p < 0.05.*

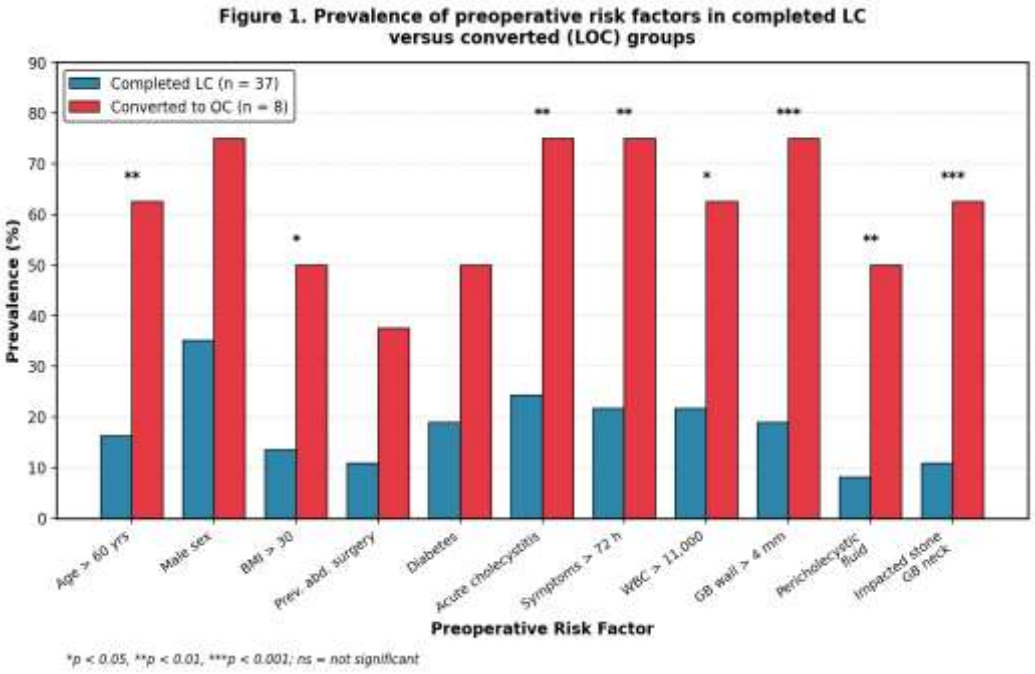


**Figure 1:** Comparative prevalence of preoperative risk factors between patients who underwent completed laparoscopic cholecystectomy and those requiring conversion to open cholecystectomy.

### *Independent predictors of conversion*

On multivariate binary logistic regression analysis, five factors emerged as independent predictors of conversion from LC to OC. The results are summarised in Table 3 and depicted graphically as a forest plot in Figure 3. A thickened gallbladder wall (> 4 mm) on preoperative ultrasonography carried the highest adjusted odds ratio (aOR 8.7; 95% CI 1.8–42.1; p = 0.007), followed by acute cholecystitis at presentation (aOR 6.8; 95% CI 1.4–32.4; p = 0.017), impacted stone in the gallbladder neck (aOR 5.9; 95% CI 1.2–28.4; p = 0.026), duration of symptoms greater than 72 hours (aOR 5.4; 95% CI 1.3–22.6; p = 0.021) and male sex (aOR 4.2; 95% CI 1.1–16.5; p = 0.040).

**Table 3:** Independent predictors of conversion from LC to OC on multivariate binary logistic regression analysis.

| Predictor | Adjusted OR | 95% Confidence Interval | p-value |
|---|---|---|---|
| Gallbladder wall thickness > 4 mm | 8.7 | 1.8 – 42.1 | **0.007** |
| Acute cholecystitis | 6.8 | 1.4 – 32.4 | **0.017** |
| Impacted stone in gallbladder neck | 5.9 | 1.2 – 28.4 | **0.026** |
| Duration of symptoms > 72 h | 5.4 | 1.3 – 22.6 | **0.021** |
| Male sex | 4.2 | 1.1 – 16.5 | **0.040** |

*OR = odds ratio. All variables entered showed p < 0.10 on univariate analysis. Model fit assessed by Hosmer–Lemeshow goodness-of-fit test (p = 0.68). Nagelkerke $R^2$ = 0.62.*

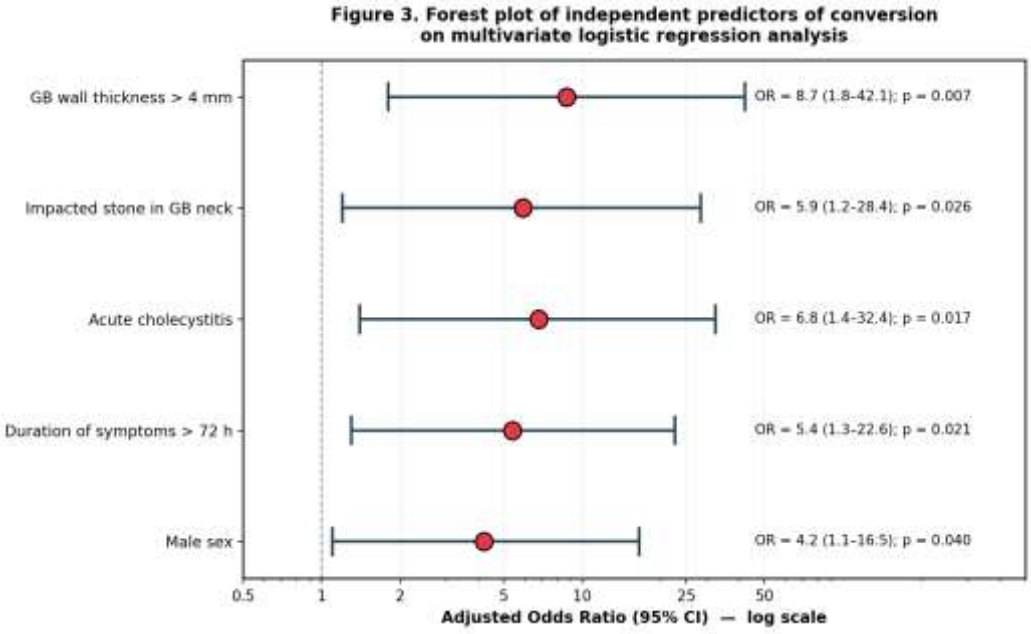


**Figure 3:** Forest plot showing adjusted odds ratios (aOR) with 95% confidence intervals of the independent predictors of conversion from laparoscopic to open cholecystectomy on multivariate binary logistic regression analysis.

### *Intraoperative reasons for conversion*

The reasons for conversion in the 8 patients are summarised in Table 4 and depicted in Figure 2. Dense adhesions with obscured anatomy at Calot's triangle was the single commonest reason, accounting for 3 (37.5%) of the 8 conversions. A "frozen" Calot's triangle was the reason in 2 patients (25.0%), while uncontrolled intraoperative bleeding, suspected common bile duct injury and gangrenous gallbladder with perforation and stone spillage accounted for 1 patient (12.5%) each.

**Table 4:** Intraoperative reasons for conversion from LC to OC (n = 8).

| Reason for conversion | Number of patients | Percentage (%) |
|---|---|---|
| Dense adhesions with obscured anatomy at Calot's triangle | 3 | 37.5 |
| Frozen Calot's triangle | 2 | 25.0 |
| Uncontrolled intraoperative bleeding | 1 | 12.5 |
| Suspected common bile duct injury | 1 | 12.5 |
| Gangrenous gallbladder with perforation and stone spillage | 1 | 12.5 |
| **Total** | **8** | **100.0** |

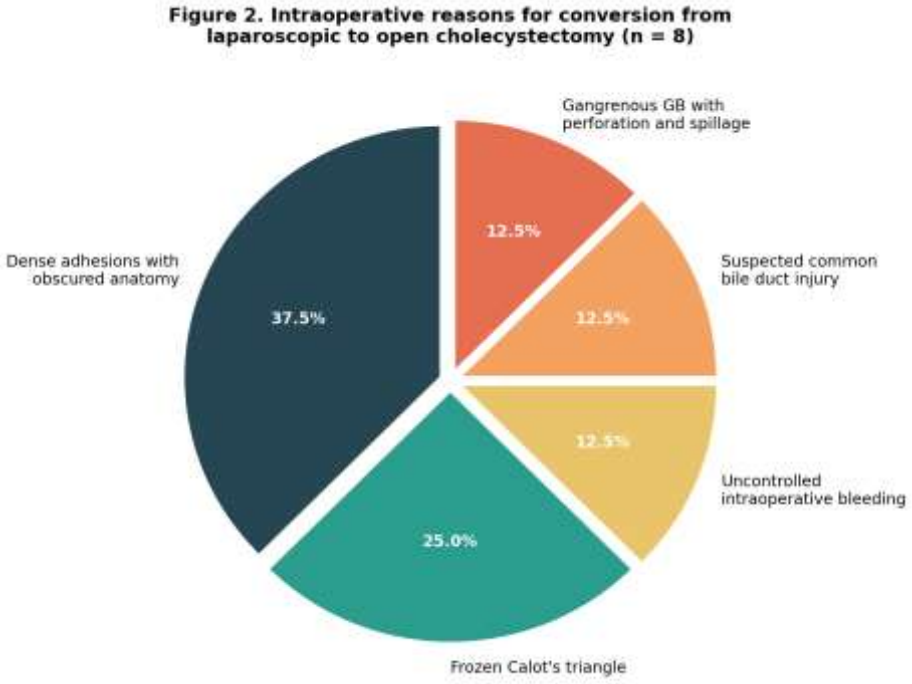


**Figure 2:** Pie chart showing the distribution of intraoperative reasons for conversion from laparoscopic to open cholecystectomy (n = 8).

### *Operative and postoperative outcomes*

The mean operative duration was significantly longer in the LOC group (118 ± 22 minutes) compared with the completed LC group (65 ± 12 minutes; $p < 0.001$). Similarly, the mean postoperative hospital stay was significantly prolonged in the LOC group (6.8 ± 2.1 days) compared with the completed LC

group (2.4 ± 0.8 days; $p < 0.001$). Postoperative complications occurred in 3 patients (8.1%) of the completed LC group and in 4 patients (50.0%) of the LOC group ($p = 0.005$). The specific complications encountered are detailed in Table 5. There was no mortality in either group during the study period.

**Table 5:** Operative parameters and postoperative outcomes.

| Outcome | Completed LC (n = 37) | Converted (LOC) (n = 8) | p-value |
|---|---|---|---|
| Operative duration (min), mean ± SD | 65 ± 12 | 118 ± 22 | **< 0.001** |
| Hospital stay (days), mean ± SD | 2.4 ± 0.8 | 6.8 ± 2.1 | **< 0.001** |
| Any postoperative complication, n (%) | 3 (8.1) | 4 (50.0) | **0.005** |
| Surgical site infection, n (%) | 2 (5.4) | 3 (37.5) | **0.015** |
| Bile leak, n (%) | 1 (2.7) | 1 (12.5) | 0.325 |
| Chest complications, n (%) | 0 (0.0) | 1 (12.5) | 0.178 |
| 30-day mortality, n (%) | 0 (0.0) | 0 (0.0) | – |

*LC = laparoscopic cholecystectomy; LOC = laparoscopic converted to open cholecystectomy; SD = standard deviation. Values in bold are statistically significant at $p < 0.05$.*

## DISCUSSION

Laparoscopic cholecystectomy has firmly established itself as the standard of care for symptomatic gallstone disease. However, the possibility of conversion to open cholecystectomy remains, and reflects sound surgical judgement rather than a technical failure. The present study, conducted over an approximately two-month period at a tertiary care teaching hospital in South India, sought to determine the incidence of and factors associated with conversion from LC to OC.

The overall conversion rate observed in the present cohort was 17.8%. This figure lies at the upper end of the range reported in the literature, which varies from 2% to 15% in most large series, but is comparable to the conversion rates reported from Indian tertiary teaching hospitals, where the referred case-mix tends to include a higher proportion of complicated and difficult cholecystectomies. Sakpal et al., in a comprehensive review, noted that conversion rates have declined worldwide over the last two decades because of accumulated surgical experience, better instrumentation and refined patient selection, but that centre-specific factors including case-mix and surgeon experience continue to influence conversion rates. Tayeb et al. reported a conversion rate of 5.9% in Pakistan, while Ibrahim et al. reported 3.6% in a Singaporean cohort and Simopoulos et al. reported 6.7% in Greece. The higher rate observed in the present study probably reflects the mixed elective and emergency case-load seen at a tertiary teaching hospital and the inclusion of cases with acute cholecystitis,

which is well known to increase conversion risk.

Male sex has been repeatedly identified in the literature as a risk factor for conversion, and this observation was confirmed in the present study, where male patients accounted for 75% of the conversion group compared with 35.1% of the completed LC group (adjusted OR 4.2; p = 0.040). Yol et al., in a study of 638 patients, showed that men had a significantly higher conversion rate than women (7.4% vs 2.3%), a finding they attributed to the greater incidence of severe fibrosis, gallbladder wall thickening and dense pericholecystic inflammation in male patients. Similar findings have been reported by Bat and by Kama et al. Whether this reflects a delayed presentation in male patients or a genuine sex-related difference in the pathology of gallstone disease remains a matter of debate.

Older age was significantly associated with conversion in the present study, with a mean age of 57.9 ± 10.4 years in the LOC group compared with 43.8 ± 11.9 years in the completed LC group. Elderly patients often have a longer duration of gallstone disease, an increased burden of comorbidities, more severe inflammation and denser adhesions, all of which can complicate laparoscopic dissection. Rosen et al. and Lipman et al. have both reported age above 65 years as an independent predictor of conversion in their series. However, in the present multivariate analysis, age did not retain its independent significance, most likely because its effect was mediated through associated pathological factors such as gallbladder wall thickness and acute cholecystitis.

Obesity, defined as a BMI greater than 30 kg/m², was significantly more frequent in the LOC group. The technical challenges of laparoscopic surgery in the obese patient – a thickened abdominal wall, a fat-laden hepatoduodenal ligament and reduced working space – are well recognised. Nevertheless, in the present multivariate analysis, obesity did not emerge as an independent predictor. This is consistent with recent evidence suggesting that with appropriate equipment and adequate surgeon experience, obesity per se should not preclude a laparoscopic approach.

Acute cholecystitis at presentation emerged as one of the strongest predictors of conversion in the present study (adjusted OR 6.8; p = 0.017). The oedema, hyperaemia and adhesions associated with acute inflammation obscure the anatomy of Calot's triangle, increase the risk of bleeding and make safe identification of the cystic duct and cystic artery more difficult. Conversion rates in acute cholecystitis have been reported to be as high as 30% or more in earlier series, although recent data from Le et al. and others suggest that with early surgery (within 72 hours of onset) and appropriate experience, this rate can be substantially reduced. In the present study, a duration of symptoms exceeding 72 hours before surgery was also an independent predictor of conversion, reinforcing the well-established recommendation that acute cholecystitis is best managed by early laparoscopic cholecystectomy, ideally within the first 72 hours of symptom onset.

A gallbladder wall thickness greater than 4 mm on preoperative ultrasonography was the single

strongest independent predictor of conversion in the present cohort (adjusted OR 8.7; p = 0.007). A thickened gallbladder wall reflects chronic transmural inflammation, fibrosis or acute oedema, and is associated with dense adhesions to the surrounding structures and obliteration of the tissue planes at Calot's triangle. This finding is in agreement with a substantial body of literature, including the studies of Fried et al., Bickel et al. and Bourgouin et al., all of whom identified a thickened gallbladder wall as a strong predictor of a difficult LC and of conversion. Ultrasonography is therefore not merely a diagnostic tool for gallstone disease but also an important instrument of risk stratification prior to LC.

The presence of an impacted stone at the neck of the gallbladder was another strong predictor of conversion in the present study (adjusted OR 5.9; p = 0.026). An impacted stone, particularly at the infundibulum, distorts the local anatomy, may produce Mirizzi syndrome and can make the safe dissection of the cystic duct and identification of the critical view of safety extremely challenging. Similar observations have been made by Simopoulos et al. and by Bat.

Leukocytosis and elevated serum bilirubin were also significantly more frequent in the LOC group on univariate analysis. These biochemical markers of the severity of inflammation and of possible common bile duct involvement should raise the operating surgeon's index of suspicion for a difficult cholecystectomy. Their independent contribution, however, was attenuated on multivariate analysis, most likely because their effect was captured by the clinical diagnosis of acute cholecystitis.

The commonest intraoperative reason for conversion in the present study was dense adhesions with obscured anatomy at Calot's triangle (37.5%), followed by a frozen Calot's triangle (25.0%). Together, these anatomical difficulties accounted for 62.5% of all conversions and reflect the same underlying pathology of chronic and acute inflammation described above. Adherence to the doctrine of the critical view of safety, and the low threshold for conversion when this view cannot be safely obtained, are the corner-stones of the prevention of major bile duct injury.

Converted patients had a significantly longer operative duration, a longer hospital stay and a higher rate of postoperative complications, especially surgical site infection. These findings mirror the observations of previous authors and underline the importance of preoperative identification of high-risk patients. Preoperative counselling of such patients should include a realistic discussion of the possibility of conversion and its implications, and operative planning should include allocation of adequate theatre time and the availability of a senior surgeon.

***Limitations of the study***

Certain limitations of the present study must be acknowledged. First, this was a single-centre retrospective study with a relatively small sample size, which may limit the statistical power to detect associations of small effect and the external generalisability of the findings. Second, the study period was limited to

approximately two months, and seasonal or referral-pattern variations may have influenced the case-mix. Third, some potentially important variables, such as detailed radiological grading (for example, the Tokyo Guidelines severity grade for acute cholecystitis), and formal surgeon-specific experience data, could not be uniformly retrieved from the records. Finally, being retrospective, the study is subject to the inherent limitations of record-based research, including missing data and the possibility of information bias. Nevertheless, the study identifies clinically meaningful risk factors that are consistent with the international literature and can be used in day-to-day surgical decision-making.

## CONCLUSION

In this retrospective cohort of 45 patients undergoing laparoscopic cholecystectomy at a tertiary care teaching hospital in South India, the conversion rate to open cholecystectomy was 17.8%. Five factors emerged as independent predictors of conversion on multivariate analysis: a gallbladder wall thickness greater than 4 mm on preoperative ultrasonography, acute cholecystitis at presentation, an impacted stone in the gallbladder neck, a duration of symptoms greater than 72 hours and male sex. The commonest intraoperative reasons for conversion were dense adhesions and a frozen Calot's triangle, both reflecting the underlying pathology of severe inflammation.

These findings underline the value of a careful preoperative clinical and ultrasonographic assessment before every laparoscopic cholecystectomy. Preoperative recognition of high-risk patients allows for realistic patient counselling, informed consent that specifically addresses the possibility of conversion, and appropriate operative planning – including the scheduling of the procedure with a senior surgeon and adequate theatre time. Conversion should not be regarded as a failure of surgical technique, but rather as an expression of surgical judgement in the interest of patient safety. Larger multicentric prospective studies are warranted to develop and validate a preoperative risk-scoring system based on these factors, applicable to the Indian population.

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