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Research Article

Factors Associated with Conversion from Laparoscopic to Open Cholecystectomy and Early Postoperative Outcomes: A Retrospective Observational Study

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Abstract: ***Introduction*** *Laparoscopic cholecystectomy is the standard procedure for symptomatic gallbladder disease, yet a proportion of cases require conversion to open surgery because of difficult anatomy, dense adhesions, bleeding, or severe inflammation.****Objectives:*** *To determine the frequency and operative circumstances of conversion from laparoscopic to open cholecystectomy and to describe early postoperative outcomes in a tertiary-care hospital.****Methods:*** *This retrospective observational study included 100 patients who underwent attempted laparoscopic cholecystectomy. Demographic details, operative indication, conversion status, intraoperative causes of conversion, postoperative complications, and length of hospital stay were extracted from case records and analyzed descriptively.****Results:*** *Patients aged 31-45 years formed the largest group, and women constituted nearly two-thirds of the cohort. Symptomatic cholelithiasis was the commonest indication for surgery, followed by acute calculous cholecystitis. Conversion to open cholecystectomy occurred in 12% of cases. Dense adhesions around the gallbladder were the leading operative reason for conversion, followed by severe inflammation and difficult Calot's triangle anatomy. Most patients had an uneventful recovery. Surgical site infection was the most frequent early complication, while bile leak, postoperative fever, prolonged hospital stay, and reoperation were uncommon. More than half of the patients were discharged within three days.****Conclusion:*** *Conversion from laparoscopic to open cholecystectomy was infrequent but clinically relevant, and it was mainly linked to inflammatory and anatomical difficulty encountered during dissection. Early postoperative outcomes were favorable in most patients, supporting laparoscopic cholecystectomy as a safe approach when performed with timely conversion in difficult cases.*

Keywords: laparoscopic cholecystectomy; conversion to open surgery; acute cholecystitis; postoperative outcomes; gallstone disease

INTRODUCTION

Laparoscopic cholecystectomy has become the accepted standard of care for the treatment of symptomatic gallstone disease because it offers less postoperative pain, shorter hospitalization, earlier return to routine activity, and lower wound morbidity than open cholecystectomy [1]. Despite these advantages, the procedure can become technically demanding in the presence of acute inflammation, dense adhesions, distorted anatomy, fibrosis, obesity, previous upper abdominal surgery, or intraoperative bleeding [1-3]. In such situations, continuation of laparoscopic dissection under unsafe conditions can increase the risk of bile duct injury, vascular trauma, bowel injury, and other serious complications. For this reason, timely conversion to open cholecystectomy is regarded as a sound surgical judgment rather than a procedural failure [2,3].

Current guidance strongly supports safe cholecystectomy principles, especially in difficult gallbladder surgery. The critical view of safety, careful identification of biliary anatomy, selective use of bailout strategies, and readiness to convert when dissection becomes hazardous are essential components of good operative practice [2,3]. The Tokyo Guidelines 2018 further underscore the importance of severity assessment in acute cholecystitis, early surgery in suitable patients, and performance of difficult cases in settings with adequate surgical expertise [4-6]. These recommendations are especially relevant in tertiary-care

hospitals where both elective and emergency gallbladder disease are frequently managed.

The decision to convert is usually driven by a combination of patient factors, disease severity, and intraoperative findings. Previous studies have shown that male sex, older age, acute cholecystitis, gallbladder wall thickening, pericholecystic fluid, severe inflammation, and prior abdominal surgery are among the important determinants of conversion [7-12]. Systematic reviews have emphasized that no single variable fully predicts conversion risk; rather, the probability rises when multiple adverse clinical and radiological features coexist [9]. At the operative level, dense adhesions, inability to achieve a critical view of safety, difficult Calot's triangle anatomy, and uncontrolled bleeding remain the commonest immediate reasons for abandoning the laparoscopic approach [2,6,10-12].

Although conversion rates have declined with increasing surgeon experience and better imaging, conversion continues to occur in a meaningful minority of cases and remains associated with longer operating time, longer hospital stay, and higher short-term morbidity than uncomplicated laparoscopic procedures [10-13]. Understanding local patterns of conversion is therefore important for preoperative counseling, operating room preparedness, audit of surgical outcomes, and quality improvement. Hospital-based retrospective analyses also help identify the dominant operative challenges in a given setting, whether these are primarily inflammatory, anatomical, or technical.

Against this background, the present study was undertaken to evaluate patients undergoing laparoscopic cholecystectomy at a tertiary-care center in Andhra Pradesh. The objectives of the study were to determine the rate of conversion from laparoscopic to open cholecystectomy, identify the operative factors associated with conversion, and assess early postoperative outcomes including complications and duration of hospital stay.

Methodology

Study design and setting: This retrospective observational study was conducted in the Department of General Surgery, Tirmula Medicover Hospital, Vizianagaram, Andhra Pradesh, India. The study period extended from April 2025 to September 2025. The manuscript was prepared in accordance with the principles applicable to observational surgical research, and only anonymized clinical data were used for analysis.

Study population: The study included 100 consecutive patients who underwent attempted laparoscopic cholecystectomy for symptomatic gallbladder disease during the study period. Case records were identified from operation theatre registers, inpatient files, discharge summaries, anesthesia records, and postoperative follow-up notes available in the hospital medical record system.

Eligibility criteria: Patients aged 18 years and above who underwent laparoscopic cholecystectomy for symptomatic cholelithiasis, acute calculous cholecystitis, chronic cholecystitis, or gallbladder polyp/biliary dyskinesia were included. Patients scheduled primarily for open cholecystectomy, those undergoing cholecystectomy as part of another major abdominal procedure, those with suspected or proven gallbladder malignancy, and records lacking essential perioperative details were excluded from the analysis.

Data collection: A structured data extraction form was used to collect demographic variables, sex, age group, clinical indication for surgery, operative approach, need for conversion to open cholecystectomy, and the principal intraoperative reason for conversion. Early postoperative variables included surgical site infection, bile leak, postoperative fever, reoperation, prolonged hospital stay, and overall recovery status. Duration of hospital stay was grouped as ≤3 days, 4–5 days, and >5 days.

Definitions and outcomes: The primary outcome was conversion from laparoscopic to open cholecystectomy. In this study, conversion was defined as any operation started laparoscopically but completed through an open abdominal incision because safe progress laparoscopically was not possible. Operative factors associated with conversion were identified from the surgeon's intraoperative notes and categorized as dense adhesions, severe inflammation/acute cholecystitis, difficult Calot's triangle anatomy, intraoperative bleeding, or suspected bile duct injury. Secondary outcomes were early postoperative events during the index admission or early follow-up, interpreted in line with standard surgical outcome assessment frameworks [14].

Statistical analysis: Data were entered into a spreadsheet and analyzed using descriptive statistical methods. Categorical variables were summarized as frequencies and percentages. Results are presented in tabular form with accompanying narrative interpretation. Because the study was based on retrospective record review and the available dataset was intended for descriptive analysis, the emphasis was placed on distribution of conversion events and early postoperative outcomes rather than model-based risk estimation.

Ethical considerations: Confidentiality of patient information was maintained throughout data abstraction, analysis, and manuscript preparation. Individual identifiers were removed before analysis, and the study used anonymized hospital data collected as part of routine clinical care.

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RESULTS

A total of 100 patients who underwent laparoscopic cholecystectomy for symptomatic gallbladder disease were included in this retrospective observational study. The results summarize the demographic profile, clinical indications, rate of conversion from laparoscopic to open cholecystectomy, operative factors associated with conversion, and early postoperative outcomes.

The demographic characteristics of the study population are presented in Table 1. Most patients belonged to the 31-45 year age group (36%), followed by 46-60 years (30%). Female patients constituted 62% of the cohort, indicating a female predominance among individuals undergoing surgery for gallbladder disease.

Table 1. Demographic characteristics of the study population (N = 100)

Variable	Category	n	%
Age group (years)	18-30	18	18.0
	31-45	36	36.0
	46-60	30	30.0
	>60	16	16.0
Sex	Male	38	38.0
	Female	62	62.0

Clinical indications for surgery are shown in Table 2. Symptomatic cholelithiasis was the commonest indication for laparoscopic cholecystectomy, accounting for 54% of cases. Acute calculous cholecystitis represented 26% of the cohort, while chronic cholecystitis and gallbladder polyp/biliary dyskinesia together constituted a smaller proportion of patients.

Table 2. Clinical indications for laparoscopic cholecystectomy (N = 100)

Indication	n	%
Symptomatic cholelithiasis	54	54.0
Acute calculous cholecystitis	26	26.0
Chronic cholecystitis	14	14.0
Gallbladder polyp / biliary dyskinesia	6	6.0

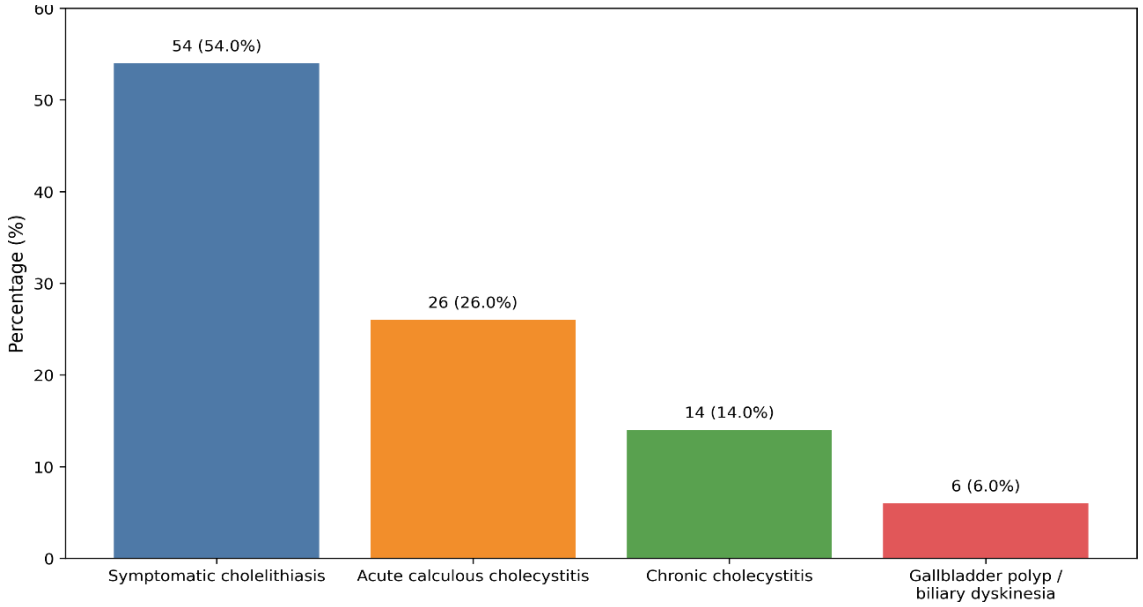

Figure 1: Clinical indications for laparoscopic cholecystectomy

The overall procedural outcome is summarized in Table 3. Laparoscopic cholecystectomy was completed successfully in 88 patients, whereas conversion to open cholecystectomy was required in 12 patients, yielding a conversion rate of 12%.

Table 3. Rate of conversion from laparoscopic to open cholecystectomy (N = 100)

Procedure outcome	n	%
Completed laparoscopically	88	88.0
Converted to open surgery	12	12.0

Among the converted cases, the intraoperative factors associated with conversion are detailed in Table 4. Dense adhesions were the leading cause, documented in 41.7% of converted procedures. Severe inflammation or acute cholecystitis accounted for 25%, and difficult Calot's triangle anatomy for 16.7%. Intraoperative bleeding and suspected bile duct injury were less frequent but important causes of conversion.

Table 4. Factors associated with conversion to open cholecystectomy (n = 12)

Factor	n	%
Dense adhesions around gallbladder	5	41.7
Severe inflammation / acute cholecystitis	3	25.0
Difficult Calot's triangle anatomy	2	16.7
Intraoperative bleeding	1	8.3
Suspected bile duct injury	1	8.3

Early postoperative outcomes are presented in Table 5. The majority of patients had an uneventful postoperative course (82%). Surgical site infection was the most frequent early complication (8%), followed by postoperative fever (5%). Bile leak was documented in 3% of cases, prolonged hospital stay in 7%, and reoperation in 1%.

Table 5. Early postoperative outcomes (N = 100)

Outcome	n	%
Uneventful recovery	82	82.0
Surgical site infection	8	8.0
Bile leak	3	3.0
Postoperative fever	5	5.0
Prolonged hospital stay (>5 days)	7	7.0
Reoperation	1	1.0

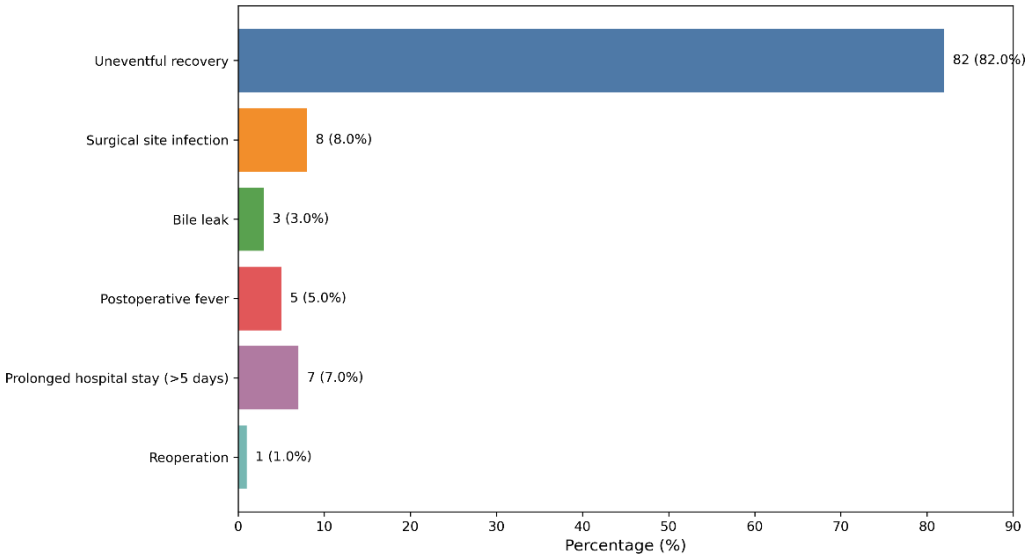

Figure 2: Early postoperative outcomes

The duration of hospital stay is shown in Table 6. More than half of the patients (58%) were discharged within 3 days, while 28% stayed for 4–5 days. Only 14% required hospitalization beyond 5 days, indicating generally favorable early recovery in the study population.

Table 6. Length of hospital stay (N = 100)

Duration of stay	n	%
<=3 days	58	58.0
4-5 days	28	28.0
>5 days	14	14.0

DISCUSSION

The present retrospective study demonstrates that laparoscopic cholecystectomy was completed successfully in most patients, with conversion to open surgery required in 12% of cases. This figure lies within the broad range reported in the literature and is close to rates described in studies of acute and difficult gallbladder disease, where conversion commonly reflects inflammatory severity and operative complexity rather than technical inadequacy [9-13]. The predominance of women in the cohort and the high proportion of symptomatic cholelithiasis are also consistent with the established epidemiology of gallstone disease [1,4].

A notable finding in the present series is that dense adhesions were the commonest operative circumstance linked to conversion, followed by severe inflammation and difficult Calot's triangle anatomy. Similar mechanisms have been reported repeatedly in prior studies. Wiebke et al. and Kanaan et al. identified inflammatory changes and acute cholecystitis as important contributors to conversion [7,8]. Hu et al., in their systematic review, also found that gallbladder inflammation, adhesions, and anatomical difficulty consistently increase the likelihood of open conversion across heterogeneous settings [9]. More recent reports by Kara and Kalayci and by Morales-Maza et al. likewise reinforce the role of inflammatory burden and adverse operative conditions in difficult dissection and conversion [11,12]. In practical terms, these observations support careful preoperative risk assessment and readiness for bailout or conversion when safe laparoscopic progress cannot be maintained.

The conversion pattern observed in this study also aligns with contemporary safe cholecystectomy principles. Strasberg and Brunt emphasized that achievement of the critical view of safety is central to preventing biliary misidentification [2]. When this view cannot be obtained because of severe inflammation, fibrosis, bleeding, or distorted anatomy, guidelines recommend alternative strategies, including subtotal cholecystectomy, fundus-first dissection, intraoperative imaging where available, or timely conversion to open surgery [3,6]. The Tokyo Guidelines 2018 similarly advocate severity-based management of acute cholecystitis and emphasize that difficult cases should be managed by experienced teams in appropriately equipped centers [4-6].

Early postoperative outcomes in the present study were generally favorable. Most patients had an uneventful recovery, and the observed complications were limited in frequency. Surgical site infection was the most common postoperative event, while bile leak and reoperation were rare. This overall pattern is comparable to published experience showing that, although converted cases tend to have greater morbidity than uncomplicated laparoscopic procedures, acceptable short-term outcomes can still be achieved when conversion is performed in a timely and judicious manner [10,13]. From a quality-of-care perspective, the relatively short hospital stay for the majority of patients further supports the continued value of laparoscopic cholecystectomy as the preferred approach.

Taken together, the present findings underline an important clinical message: the safest cholecystectomy is not always the one completed laparoscopically, but the one completed without avoidable injury. Recognition of dense adhesions, severe inflammation, and unclear biliary anatomy at the right moment can reduce operative risk and preserve good postoperative recovery. Regular audit of conversion patterns at institutional level remains valuable for surgical training, case selection, and perioperative planning.

Limitations

This study has important limitations. It was retrospective, single-center, and based on a sample of 100 patients, which restricts generalizability. The analysis depended on the completeness and accuracy of operative records. Detailed laboratory, ultrasonographic, and surgeon-experience variables were not uniformly available for comparative modeling. Long-term outcomes beyond the early postoperative period were also not assessed in this dataset.

CONCLUSION

Laparoscopic cholecystectomy remained the definitive operative approach for most patients with symptomatic gallbladder disease in this study, with only a minority requiring conversion to open surgery. Conversion was chiefly encountered in the presence of dense adhesions, marked inflammatory changes, and difficult biliary anatomy, underscoring the importance of intraoperative judgment and adherence to safe cholecystectomy principles. Early postoperative outcomes were satisfactory overall, with most patients recovering uneventfully and only a small proportion experiencing surgical site infection, bile leak, fever, prolonged hospitalization, or reoperation. These findings support continued use of laparoscopic cholecystectomy as the preferred approach, while emphasizing that timely

conversion remains an important safeguard against avoidable operative injury.

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