

Incidence, Pattern and Risk Factors of Complications Following Cholecystectomy for Acute Cholecystitis: A Retrospective Study

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Abstract:

Background: Acute cholecystitis is a frequent surgical emergency, and cholecystectomy is the definitive treatment. In a small number of cases, however, there are postoperative complications and conversion to open surgery which is more likely in patients with severe inflammation and/or other comorbidities.

Objective: To evaluate the rates, nature and risk factors for complications after cholecystectomy in patients with acute cholecystitis.

Methodology: This is a hospital based retrospective observational study carried out in the Department of General Surgery, Nalanda Medical college and hospital, Patna. A total of 110 adult cholecystectomy patients for acute calculous cholecystitis were examined. The records of 110 adult patients who had undergone cholecystectomy for acute calculous cholecystitis were reviewed. Operative, demographic, laboratory, clinical and post-operative variables were analyzed. Complications were defined as per the Clavien–Dindo classification, and risk factors were analyzed by univariate and multivariate analysis.

Result: Consequently, open surgery was performed in 22.7% of patients and postoperative complications were seen in 18.2%. Complications were mostly minor and treated conservatively. Advanced age, diabetes, high levels of CRP, gallbladder gangrene, and the presence of an intra-operative abscess were significant predictors of conversion. Age, male gender, impaired renal function, and conversion to open surgery were independent predictors of postoperative complications.

Conclusion: It is generally safe to perform cholecystectomy on patients with acute cholecystitis but is more likely to be complicated in the high-risk patient with advanced age, comorbidities, or severe inflammation of the gallbladder on operation. Prevention of complications by early risk assessment and optimised peri-operative care can have a positive impact.

Keywords: Acute Cholecystitis, Cholecystectomy, Postoperative Complications, Conversion, Risk Factors, Clavien–Dindo Classification.

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Introduction

Acute cholecystitis is one of the most frequently occurring surgical emergencies in general surgical practice and is usually due to the obstruction of the cystic duct by a gallstone accounting for inflammation of the gall bladder. It is a major cause of hospital admission for biliary tract disorders, and when left untreated, it can lead to high morbidity. Increased incidence of gallstone disease is due to globalization of dietary pattern, obesity, sedentarism and the ageing population. Gall stone disease has been identified as a serious public health problem in India es-

pecially in the middle-aged and older age groups and there is a higher prevalence of such disease among women than men [1].

Cholecystectomy is still the gold standard treatment in acute calculous cholecystitis. Since the inception of the procedure, laparoscopic cholecystectomy has been accepted as the gold standard procedure due to the benefits of less postoperative pain, shorter hospitalisation, faster recovery, better cosmetic results and lower overall morbidity in comparison to open

cholecystectomy [2]. It is now suggested by international guidelines that early laparoscopic cholecystectomy should be performed during the first admission, since this will decrease the frequency of recurrent biliary events and the overall burden of the disease [3]. Even with the improvement in surgery, anesthetic and peri-operative management, the postoperative complications associated with cholecystectomy still occur and can have a significant impact on the outcome of the patient.

Postoperative complications can include minor (such as infections, postoperative nausea and vomiting, and urinary tract infection) and major (such as injury to the bile duct, leakage of bile, intra-abdominal abscess, bleeding, bowel injury, and cardiopulmonary complications) complications [4,5]. The risk of serious complications is relatively low but if it does occur, it can lead to extended hospital stays, higher health care expenses, re-interventions, and, if severe, death. Patients with acute cholecystitis are more likely than patients undergoing elective cholecystectomy to have tissue edema, adhesions, distorted anatomy and surgical dissection challenges, which increases the risk of complications [6].

Several investigators have tried to determine factors that are associated with poor outcomes after a cholecystectomy. The advanced age, male sex, obesity, diabetes mellitus, hypertension, and other underlying medical conditions have been reported to affect postoperative outcomes. Other disease-related factors such as severity and longer duration of acute cholecystitis, presence of gangrenous gallbladder or perforation of the gallbladder, high inflammatory markers and delayed presentation can further complicate the surgery and could increase the chances of complications [7]. Operative factors including extended operative time, dense adhesions in Calot's triangle, intraoperative bleeding, conversion from laparoscopy to laparotomy and surgeon experience have also been found to be important factors in determining postoperative morbidity [8].

Laparoscopic to open cholecystectomy conversion is still a significant issue in the treatment of acute cholecystitis. Conversion is not considered a failure of the procedure but may be required for patient safety when anatomical landmarks are poorly identified or the procedure is complicated. Patients who need conversion to laparotomy typically have a higher incidence of postoperative complications, longer operating room times and longer hospital stays than patients who undergo successful laparoscopic surgery [9]. Thus, the ability to recognise predictors of difficult surgery and postoperative complications is crucial for patient counselling, surgical planning, resource allocation and maximising outcomes.

The knowledge of the incidence and pattern of complications in particular healthcare environments is also crucial since the outcome may differ based on patient characteristics, disease characteristics, institutional resources and surgical skills. Information about the complications after cholecystectomy is largely from developed countries and tertiary care centers, and information in Eastern India is relatively scarce. Regional studies are of special interest because it is well known that patients often present late in the disease course and that socioeconomic and access factors to the healthcare system vary markedly regionally and these may affect treatment outcomes [10].

A large population from Bihar and neighbouring regions is served by the Nalanda Medical College and Hospital, Patna, which is a major tertiary care teaching institute. Acute cholecystitis is a significant part of the Emergency and elective surgical admissions to the Department of General Surgery. Assessing postoperative complications in these contexts can yield important information on local disease burden, surgical outcomes and risk factors for complications. The evidence can assist in the identification of high-risk patients, enhance management strategies before and after surgery, and minimize complications by targeted interventions.

Hence the present Retrospective study was done in the Department of General Surgery, Nalanda Medical College and Hospital Patna, Bihar to find out the incidence and pattern of complication after Cholecystectomy for acute cholecystitis and to see whether there are any risk factors involved or not. The results of this study will add to the body of evidence to help develop strategies to improve patient safety and surgical outcomes in routine clinical practice.

Methodology

Study Design: This study was a retrospective, observational hospital-based study to assess the incidence, pattern and risk factors for the complications after cholecystectomy for acute cholecystitis. Demographic, clinical, operative, and postoperative parameters associated with surgical outcome were analyzed in medical records of eligible patients reviewed in a retrospective fashion.

Study Area: The study was conducted in Department of General Surgery, Nalanda Medical College and Hospital (NMCH), Patna, Bihar, India from December 2024 to November 2025.

Study Duration: Patients with acute cholecystitis who underwent cholecystectomy within a year were included in the study. Permission to collect data and review records was obtained, followed by collection and review.

Sample Size: Overall, 110 patients with acute calculous cholecystitis who were admitted for chole-

cystectomy during the study period and met the inclusion criteria were enrolled in the study.

Study Population: The subjects of the study were adult patients with a diagnosis of acute calculous cholecystitis and who were operated on for cholecystectomy in the Department of General Surgery, NMCH, Patna. Diagnosis was made on clinical presentation, laboratory investigations and radiology findings which were consistent with acute cholecystitis.

Data Collection: The data were obtained from hospital records, operation theatre registers, discharge summaries, and from patient case files. Data was collected on a structured form on the following parameters: demographic, clinical presentation, laboratory investigation, radiological investigation, intraoperative findings, operative details and postoperative outcome.

Age, sex, and duration of symptoms, comorbidities, BMI, previous biliary disease, laboratory data (WBC, CRP, LFT), ultrasonographic findings, operative approach, surgery time, intraoperative findings, postoperative complications, and duration of hospital stay and management of complications were recorded.

The diagnosis of acute calculous cholecystitis was made when gallstones were detected on ultrasonography or during operation and clinical findings included the presence of right upper quadrant pain, Murphy's sign, fever, leukocytosis, elevation of inflammatory markers, and imaging evidence of gallbladder inflammation such as thickened gallbladder wall, pericholecystic fluid collection, edema, or distention of the gallbladder

Inclusion Criteria

- Patients 18 years or older.
- Patients are diagnosed with acute calculous cholecystitis.
- Patients who had undergone cholecystectomy in the study period.
- Patients who have complete medical records and who are followed up after surgery while in the hospital.

Exclusion Criteria

- Acalculous cholecystitis patients.
- Non-surgical treatment of patients.
- Gallbladder cancer patients undergo cholecystectomy.
- Patients who have had cholecystectomy for any other major abdominal surgery.
- Patients whose clinical record is incomplete, or without operative/postoperative information.
- Pre-treatment referrals to other centres.

Study Procedure: The medical records of all patients who underwent cholecystectomy for acute cal-

culous cholecystitis during the study period were screened. Patients eligible for the study who fulfilled the inclusion criteria were recruited. Preoperative evaluation, surgical procedure, intraoperative findings and postoperative course were discussed.

Postoperative complications in the hospital were recognized and categorized by the Clavien–Dindo Classification system. Complications were grouped under either surgical (bile leak, surgical site infection, hemorrhage, intraabdominal collection, bile duct injury) or medical (respiratory, cardiovascular, or thromboembolic). Incidence and the pattern of complications were noted and possible risk factors for complications were assessed.

Statistical Analysis: The data were entered into MS Excel and analysed using Statistical Package for Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA).

Categorical variables were summarized as frequency and percentage, and continuous variables were expressed as mean $\pm$ SD or median (IQR), depending on distribution of data. The categorical variables were compared using Chi-square test or Fisher's exact test. The Independent t-test or the Mann–Whitney U test was used to compare continuous variables as appropriate.

Those variables that were statistically significant in univariate analysis ($p < 0.05$) were entered into multivariate logistic regression models to determine independent risk factors associated with postoperative complications. Odds Ratios (ORs) and 95% Confidence intervals (CIs) were computed. The p value < 0.05 was considered to be statistically significant”.

Result

The results of univariate analysis are summarized in Table 1, which shows the relationship between the different clinical and operative parameters and the conversion to open surgery. The conversion rate overall was 22.7%. Higher age was significantly associated with conversion, suggesting that elderly patients have a higher risk of conversion as they have less physiological reserve and the disease is more advanced. However, elevated CRP levels (>150 mg/L) displayed a strong and statistically significant association, indicating that severe inflammation is likely to be a key factor in determining if a surgical procedure will be difficult or not. Diabetes mellitus also had a significant association which is related to the effect of metabolic disorders on the severity of the diseases and healing responses. Moreover, gangrene and abscesses, as detected intraoperatively, were important predictors of conversion, highlighting the great difficulty of the surgery where pathological conditions are severe. There was no statistical significance among other variables such as gender, renal function and WBCC, but there was a trend of higher risk with each of these.

Table 1: Univariate Analysis of Risk Factors for Conversion (N = 110)

Variable	Conversion (n = 25, 22.7%)	LC (n = 85)	Total (n = 110)	OR (95% CI)	P value
Gender (Male)	15 (60.0%)	38 (44.7%)	53 (48.2%)	1.8 (0.7–4.3)	0.182
Age ≥ 65 years	17 (68.0%)	32 (37.6%)	49 (44.5%)	3.5 (1.4–8.6)	0.006
Diabetes	10 (40.0%)	18 (21.2%)	28 (25.5%)	2.5 (1.0–6.4)	0.048
Impaired renal function	4 (16.0%)	6 (7.1%)	10 (9.1%)	2.5 (0.6–9.9)	0.2
Duration of symptoms >72 h	12 (48.0%)	25 (29.4%)	37 (33.6%)	2.2 (0.9–5.4)	0.088
CRP >150 mg/L	18 (72.0%)	28 (32.9%)	46 (41.8%)	5.2 (2.0–13.4)	<0.001
WBCC >13 ×10 ⁹ /L	14 (56.0%)	30 (35.3%)	44 (40.0%)	2.3 (0.9–5.6)	0.073
Gallbladder gangrene	12 (48.0%)	10 (11.8%)	22 (20.0%)	6.7 (2.3–18.9)	<0.001
Abscess (intraoperative)	6 (24.0%)	4 (4.7%)	10 (9.1%)	6.3 (1.6–24.6)	0.004

The multivariate logistic regression analysis showed that independent predictors for conversion after adjusting for confounding variables are presented in table 2. Even though the level of CRP below 150 mg/L was no longer a strong independent predictor, this finding still further emphasizes the importance of inflammation as a determinant of operative difficulty. Also, age ≥65 years remained significant, suggesting that age is an independent risk factor irrespective of other risk factors. Intraoperative findings of gan-

grene and abscess were the strongest predictor variables, highlighting that the stage of disease is a significant factor in its conversion. The relationship between diabetes and more severe inflammatory conditions may partially explain the association with diabetes, which was borderline significant. The overall results suggest that patient related factors and disease severity both play a role in determining the risk of conversion.

Table 2: Independent Risk Factors for Conversion (Logistic Regression, N = 110)

Risk Factor	OR (95% CI)	P value
CRP >150 mg/L	3.8 (1.5–9.5)	0.004
Age ≥ 65 years	2.6 (1.1–6.3)	0.032
Diabetes	2.1 (0.9–5.4)	0.049
Gangrene of gallbladder	4.9 (1.9–12.6)	<0.001
Abscess	5.7 (1.5–21.4)	0.008

Factors associated with postoperative complications are analysed in Table 3; these complications occurred in 18.2% of the patients. Complications were strongly associated with the elderly age (≥65 years), suggesting that the elderly patients are more prone to poor outcomes following surgery. Male gender also demonstrated a significant association implying gender related differences in disease presentation and/or physiological response. Impaired renal function was another important predictor, highlighting

the role of underlying comorbidities in postoperative recovery. Higher CRP levels and gangrene signified that there is a higher risk in complications with more intense inflammation. Also, there was a significant association of conversion to open surgery with the higher complication rate, which implies that the patients undergoing conversion are already at higher risk because of complexity and severity of the disease. Although diabetes did not prove significant in this analysis, there was a moderate risk increase.

Table 3: Univariate Analysis of Risk Factors for Postoperative Complications (N = 110)

Variable	Complications (n = 20, 18.2%)	No Complications (n = 90)	OR (95% CI)	P value
Gender (Male)	14 (70.0%)	39 (43.3%)	3.1 (1.1–8.9)	0.028
Age ≥ 65 years	15 (75.0%)	34 (37.8%)	5.0 (1.7–14.4)	0.002
Diabetes	8 (40.0%)	20 (22.2%)	2.3 (0.8–6.5)	0.111
Impaired renal function	5 (25.0%)	5 (5.6%)	5.6 (1.4–22.3)	0.01
CRP >150 mg/L	13 (65.0%)	33 (36.7%)	3.2 (1.2–8.6)	0.018
Gangrene	9 (45.0%)	13 (14.4%)	4.9 (1.7–13.7)	0.002
Conversion to open surgery	10 (40.0%)	15 (16.7%)	3.3 (1.2–9.0)	0.015

The multivariate analysis of independent predictors of postoperative complications is summarized in Table 4. The older patient remained vulnerable as aged

65 years remained an important predictor. Higher complication rates were also independent of male gender. One of the most powerful predictors was im-

paired renal function, meaning patients who had poor renal function would be less able to withstand surgical stress. Open surgery continued to be an important independent risk factor, further emphasizing

the impact of surgical difficulties and complexity on the postoperative course. Results indicate that patient comorbidities and procedural variables are important in predicting complications.

Table 4: Independent Risk Factors for Complications (Logistic Regression, N = 110)

Risk Factor	OR (95% CI)	P value
Age $\geq$ 65 years	3.2 (1.3–8.2)	0.011
Male gender	2.7 (1.1–7.1)	0.034
Impaired renal function	4.5 (1.2–16.8)	0.021
Conversion to open surgery	2.8 (1.1–7.5)	0.026

The severity and distribution of the postoperative complications following surgery are described in table 5 with the aid of the Clavien-Dindo classification. The overall complication rate was 18.2%, higher in patients who had conversion (28.0%) than in those who had laparoscopic surgery alone (15.3%). The majority of complications (88.5%) were mild (Grade I-II). A modest number of cases

needed intervention (Grade III) and mortality (Grade V) and severe complications were uncommon (Grade IV). Increased complexity of the disease process and/or the nature of the surgery in the conversion group is reflected by the higher complication rates seen in this group. Overall, most complications were controllable, and the procedure was relatively safe, but carries risks.

Table 5: Classification of Complications (Clavien-Dindo, N = 110)

Classification	LC (n = 85)	Conversion (n = 25)	Total (n = 110)	Percentage
Grade I–II	7 (8.2%)	5 (20.0%)	12	10.90%
Grade III	4 (4.7%)	2 (8.0%)	6	5.50%
Grade IV	1 (1.2%)	0	1	0.90%
Grade V (Death)	1 (1.2%)	0	1	0.90%
Total complications	13 (15.3%)	7 (28.0%)	20	18.20%

Discussion

This study aimed to assess the rate, distribution and risk factors for conversion to open surgery and postoperative complications after cholecystectomy for acute cholecystitis. Of the 110 patients in this study, 25 (22.7%) needed conversion from laparoscopic cholecystectomy (LC) to open cholecystectomy and 20 (18.2%) had postoperative complications. The results of this study suggest that laparoscopic cholecystectomy is still the recommended treatment choice for acute cholecystitis, but a significant number of patients with severe inflammation and associated diseases still have unfavorable perioperative results”.

Analysis of factors associated with conversion showed that elderly patients (≥ 65 years) were significantly more likely to have a conversion than younger patients (68.0% vs. 37.6%, OR=3.5, $p=0.006$). Gangrenous gallbladder (OR=6.7, $p<0.001$) and the presence of an abscess (OR=6.3, $p=0.004$) during the operation were also significant predictors of conversion. Multivariate analysis further confirmed CRP >150 mg/L (OR=3.8, $p=0.004$), age ≥ 65 years (OR=2.6, $p=0.032$), diabetes mellitus (OR=2.1, $p=0.049$), gangrene of the gallbladder (OR=4.9, $p<0.001$), and abscess formation (OR=5.7, $p=0.008$) as independent predictors. The results of this study are similar to those found by Johansson et al. (2014), who found advanced age, diabetes, and severe inflammatory changes to be im-

portant factors in conversion for acute cholecystitis [11]. Likewise, Bourgouin et al. found that the increased levels of inflammatory markers and complicated gall bladder disease were associated with increased operative difficulty and conversion [12].

The relationship between advanced age and conversion could be due to late presentation, chronicity of illness, and polypharmacy among elderly people. Multiple studies have indicated that older patients often have atypical symptoms and that their disease is more advanced when they undergo surgery [13]. Diabetes mellitus has also been associated with weakened immune function and microvascular compromise, which places patients at risk for developing gangrenous cholecystitis and abscesses. Nikfarjam et al. showed that patients with diabetes tend to have more complicated acute cholecystitis that may require conversion to open surgery [14]. The present study further corroborates the systemic inflammatory burden as a surrogate marker of disease severity, as there is a good correlation between elevated levels of CRP and conversion.

The complications that arose after the surgery occurred in 18.2% of the patients, which is similar to the 9-20% range reported in previous studies of acute cholecystitis [15]. Univariate analysis showed that the complications were associated with male gender (OR=3.1; $p=0.028$), age ≥ 65 years (OR=5.0; $p=0.002$), impaired renal function (OR=5.6; $p=0.010$), elevated CRP level (OR=3.2; $p=0.018$),

gangrenous gallbladder (OR=4.9; $p=0.002$) and conversion to open surgery (OR=3.3; $p=0.015$). Multivariate analysis showed that age ≥ 65 years (OR=3.2, $p=0.011$), male gender (OR=2.7, $p=0.034$), impaired renal function (OR=4.5, $p=0.021$) and conversion to open surgery (OR=2.8, $p=0.026$) were independent factors associated with postoperative morbidity.

In the present study, impaired renal function turned out to be one of the best predictors of postoperative complications. The risk of complications was almost five times greater in renal dysfunction patients. The same has been found by Lee et al., who showed that renal failure leads to significant changes in the patient's immune function, metabolic and tissue healing processes, and this is associated with increased perioperative morbidity [16]. These results highlight the need to carefully optimize these patients preoperatively and monitor them after surgery.

The number of Grade I–II complications in all patients was the highest (10.9%), according to the Clavien–Dindo classification. Major complication rates were reduced, with 5.5% and 0.9% having Grade III and IV complications respectively, and with no mortality recorded. The overall complication rate was greater for converted cases than for those performed laparoscopically (28.0% vs. 15.3%). The results indicate that the majority of complications were minor and were easily managed, but that there was an increased risk of severe inflammation and requirement for conversion. Giger et al. and de Mestral et al. have both reported similar distribution of the severity of the complications, the majority being minor and the remainder, severe complications and death, being more common in high-risk patients and emergency surgery [17].

In the current study, there was one patient who had severe disease and associated comorbidities with a mortality rate of 0.9%. This is similar to the mortality rates found in other studies of acute cholecystitis, which ranged from 0.7% to 1.1%. The findings combined suggest that age, diabetes mellitus, high inflammatory markers, gangrenous gallbladder, abscess, low renal function, male sex, and conversion to open surgery are key factors associated with a poor outcome after acute cholecystitis surgery. Identification of these factors early in the course can help with risk stratification, appropriate surgical planning and perioperative management, all of which can help to optimize patient outcomes.

Conclusion

The present study confirms that cholecystectomy is an effective and relatively safe surgical procedure for acute cholecystitis, although patients with high age, male gender, diabetes mellitus, renal dysfunction, high inflammatory response, gangrenous gallbladder, development of abscesses in the operation field and difficult field of surgery have higher rates of complications and conversion to laparot-

omy. The majority of complications were minor and were easy to manage with conservative treatment or limited intervention; severe complications were rare. The results highlight the need for accurate early diagnosis, thorough assessment of the risk factors preoperatively, optimization of comorbidities, prompt surgical intervention and ongoing postoperative monitoring of patients with acute cholecystitis to minimise morbidity and enhance surgical outcomes.

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