E-ISSN 2250-0944
ISSN 2250-1150
doi: 10.48047/ijprt/16.01.546

Research Article

Comparative Evaluation of Early Versus Delayed Laparoscopic Cholecystectomy in Acute Calculous Cholecystitis: A Cross-Sectional Analysis

Dr. Mamilla Pramod
Post Graduate, Department of General Surgery, Konaseema Institute of Medical Sciences & Research Foundation (KIMS&RF), Amalapuram, Andhra Pradesh, INDIA. Email: prams78m@gmail.com
Dr. Vamshi Krishna Gorle
Professor, Department of General Surgery, Konaseema Institute of Medical Sciences & Research Foundation (KIMS&RF), Amalapuram, Andhra Pradesh, INDIA.

Received Date:02/02/2026 ***Revised Date: 12/03/2026*** ***Accepted Date: 03/04/2026***

ABSTRACT

Background: Acute calculous cholecystitis is one of the most common surgical emergencies. Although laparoscopic cholecystectomy is considered the gold standard treatment, the optimal timing of surgery remains a subject of debate. This study compared the clinical, operative, and postoperative outcomes of early versus delayed laparoscopic cholecystectomy in patients with acute calculous cholecystitis. **Aim:** To compare the clinical and surgical outcomes of early versus delayed laparoscopic cholecystectomy in patients with acute calculous cholecystitis. **Methods:** A hospital-based cross-sectional analytical study was conducted among 200 patients diagnosed with acute calculous cholecystitis. Patients were divided into two groups: Early Laparoscopic Cholecystectomy (n=100) and Delayed Laparoscopic Cholecystectomy (n=100). Demographic characteristics, operative parameters, postoperative outcomes, and overall effectiveness and safety measures were compared between the groups. Statistical analysis was performed using SPSS version 26.0, and a p-value <0.05 was considered statistically significant. **Results:** The early laparoscopic cholecystectomy group demonstrated significantly shorter operative time (67.4 ± 14.2 vs. 82.7 ± 18.6 minutes, p<0.001), lower rates of difficult Calot's dissection (29.0% vs. 47.0%, p=0.009), dense adhesions (26.0% vs. 54.0%, p<0.001), gallbladder perforation (17.0% vs. 33.0%, p=0.009), bile spillage (21.0% vs. 38.0%, p=0.008), and conversion to open surgery (7.0% vs. 18.0%, p=0.019). Postoperative pain scores, complication rates, surgical site infections, hospital stay, and recovery time were significantly lower in the early surgery group. Overall favourable outcomes (89.0% vs. 73.0%, p=0.004), safe completion without major complications (94.0% vs. 84.0%, p=0.024), patient satisfaction scores (8.7 ± 1.1 vs. 7.2 ± 1.4, p<0.001), and cost-effectiveness were significantly better among patients undergoing early surgery. **Conclusion:** Early laparoscopic cholecystectomy offers superior operative and postoperative outcomes compared to delayed laparoscopic cholecystectomy in patients with acute calculous cholecystitis. It is associated with fewer complications, shorter hospitalization, faster recovery, improved patient satisfaction, and lower healthcare burden, supporting its role as the preferred management strategy.

KEYWORDS: Acute Calculous Cholecystitis. Early Laparoscopic Cholecystectomy. Delayed Laparoscopic Cholecystectomy.

INTRODUCTION

Acute calculous cholecystitis is one of the most common surgical emergencies encountered worldwide and is predominantly caused by obstruction of the cystic duct by gallstones. The obstruction leads to gallbladder distension, inflammation, edema, and in severe cases, ischemia and perforation. Acute calculous cholecystitis accounts for approximately 80-95% of all cases of acute cholecystitis and represents a significant burden on healthcare systems due to frequent hospital admissions and surgical interventions. The disease commonly affects adults, with a higher prevalence among females, obese individuals, and patients with metabolic disorders. Clinical manifestations typically include right upper quadrant abdominal pain, fever, nausea, vomiting, and leukocytosis, while ultrasonography remains the preferred imaging modality for diagnosis.[1]

Laparoscopic cholecystectomy has become the gold standard treatment for symptomatic gallstone disease and acute calculous cholecystitis because of its advantages such as reduced postoperative pain, shorter hospital stay, faster recovery, and better cosmetic outcomes compared to open surgery. However, the optimal timing of surgery in patients presenting with acute calculous cholecystitis has remained a matter of debate. Traditionally, delayed laparoscopic cholecystectomy was recommended after an initial period of conservative management with antibiotics and supportive care, allowing inflammation to subside before surgery. This approach was believed to reduce operative difficulty and complications.[2]

Recent advances in laparoscopic techniques, perioperative care, and surgical expertise have encouraged the adoption of early laparoscopic cholecystectomy, usually performed within 72 hours to one week of symptom onset. Several studies have demonstrated that early surgery can reduce the total duration of hospitalization, prevent recurrent gallstone-related complications, and lower overall treatment costs without significantly increasing morbidity or mortality. Furthermore, delaying surgery may expose patients to recurrent biliary colic, pancreatitis, cholangitis, or recurrent episodes of cholecystitis during the waiting period.[3]

Despite increasing evidence supporting early intervention, concerns persist regarding technical challenges associated with operating in an inflamed field, including difficulty in identifying Calot's triangle, increased risk of bile duct injury, bleeding, and conversion to open surgery. Conversely, delayed surgery may be associated with dense adhesions and fibrosis resulting from repeated inflammatory episodes, potentially increasing operative complexity. Therefore, comparative evaluation of early and delayed laparoscopic cholecystectomy is essential to determine the most effective treatment strategy for acute calculous cholecystitis.[4]

AIM

To compare the clinical and surgical outcomes of early versus delayed laparoscopic cholecystectomy in patients with acute calculous cholecystitis.

OBJECTIVES

1. To compare operative parameters including operative time, conversion rate, and intraoperative complications between early and delayed laparoscopic cholecystectomy.
2. To evaluate postoperative outcomes such as pain, complications, duration of hospital stay, and recovery time in both groups.
3. To assess the overall effectiveness and safety of early versus delayed laparoscopic cholecystectomy in acute calculous cholecystitis.

MATERIAL AND METHODOLOGY

Study Design A hospital-based cross-sectional analytical study was conducted to compare the outcomes of early and delayed laparoscopic cholecystectomy among patients diagnosed with acute calculous cholecystitis.

Source of Data Data were collected from patients admitted with acute calculous cholecystitis in the Department of General Surgery. Clinical records, operative findings, laboratory investigations, radiological reports, and postoperative follow-up data were reviewed and documented using a structured proforma.

Study Location The study was conducted in the Department of General Surgery of a tertiary care teaching hospital.

Study Duration The study was conducted over a period of 24 months from November 2023 to November 2025

Sample Size A total of 200 patients diagnosed with acute calculous cholecystitis and undergoing laparoscopic cholecystectomy were included in the study.

Group Allocation

- Group A (Early Laparoscopic Cholecystectomy): 100 patients who underwent surgery within 72 hours to 7 days of symptom onset.
- Group B (Delayed Laparoscopic Cholecystectomy): 100 patients who initially received conservative treatment and subsequently underwent surgery after 6-8 weeks.

Inclusion Criteria

1. Patients aged 18 years and above.
2. Patients diagnosed with acute calculous cholecystitis based on clinical, laboratory, and ultrasonographic findings.
3. Patients who underwent laparoscopic cholecystectomy.
4. Patients willing to participate and provide written informed consent.
5. Both male and female patients.

Exclusion Criteria

1. Patients with acalculous cholecystitis.
2. Patients with gallbladder malignancy.
3. Patients with choledocholithiasis requiring additional biliary procedures.
4. Patients with severe cardiopulmonary comorbidities unfit for surgery.
5. Pregnant women.
6. Patients requiring emergency open cholecystectomy at presentation.
7. Patients unwilling to participate in the study.

Procedure and Methodology

After obtaining informed written consent, detailed demographic and clinical information including age, sex, presenting symptoms, duration of symptoms, comorbidities, and physical examination findings were recorded. Baseline laboratory investigations such as complete blood count, liver function tests, renal function tests, coagulation profile, and serum electrolytes were performed. Ultrasonography of the abdomen was carried out to confirm the diagnosis and assess gallbladder wall thickness, presence of gallstones, pericholecystic fluid collection, and gallbladder distension. Patients were categorized into early and delayed laparoscopic cholecystectomy groups based on the timing of surgery. Standard four-port laparoscopic cholecystectomy was performed under general anesthesia by experienced surgeons following institutional protocols.

Intraoperative variables recorded included operative duration, difficulty in dissection, presence of adhesions, bile spillage, bleeding, gallbladder perforation, and conversion to open

cholecystectomy. Postoperative parameters including pain scores, duration of hospital stay, surgical site infection, bile leak, intra-abdominal collection, readmission, and recovery time were documented.

All patients were followed until discharge and during postoperative outpatient visits for assessment of complications and clinical outcomes.

Sample Processing Clinical, laboratory, imaging, operative, and postoperative data were collected using a predesigned case record form. Data were checked for completeness, accuracy, and consistency before entry into a computerized database. Coding and tabulation were performed using Microsoft Excel, and the finalized dataset was transferred to statistical software for analysis.

Statistical Methods Data were analyzed using Statistical Package for Social Sciences (SPSS) version 26.0. Continuous variables were expressed as mean ± standard deviation (SD), whereas categorical variables were expressed as frequencies and percentages. Comparison between the two groups was performed using the Independent Student's t-test for quantitative variables and Chi-square test or Fisher's exact test for qualitative variables. Odds ratios with 95% confidence intervals were calculated where applicable. A p-value less than 0.05 was considered statistically significant.

Data Collection Data collection was carried out using a structured data collection sheet. Information regarding demographic characteristics, clinical presentation, laboratory findings, ultrasonographic findings, operative details, intraoperative events, postoperative complications, duration of hospitalization, and follow-up outcomes was systematically recorded for each participant. Confidentiality of patient information was maintained throughout the study.

OBSERVATION AND RESULTS

Table 1. Clinical and surgical outcomes in early versus delayed laparoscopic cholecystectomy

Variable	Early LC n=100	Delayed LC n=100	Test of significance	95% CI	p value
Age, years	41.6 ± 10.7	45.8 ± 11.3	t=2.70	-7.27 to -1.13	0.008
Female	57 (57.0%)	49 (49.0%)	χ^2=1.29	OR 1.38; 0.79-2.42	0.257
Diabetes mellitus	19 (19.0%)	31 (31.0%)	χ^2=3.84	OR 0.52; 0.27-1.00	0.050
Fever at presentation	63 (63.0%)	41 (41.0%)	χ^2=9.69	OR 2.45; 1.39-4.32	0.002
Leukocytosis	71 (71.0%)	52 (52.0%)	χ^2=7.65	OR 2.26; 1.25-4.10	0.006
Successful laparoscopic completion	93 (93.0%)	82 (82.0%)	χ^2=5.53	OR 2.91; 1.16-7.33	0.019

Table 1 compares the baseline clinical and surgical characteristics of patients undergoing early and delayed laparoscopic cholecystectomy. The mean age of patients in the early laparoscopic cholecystectomy (LC) group was significantly lower than that in the delayed LC group (41.6 ± 10.7 years vs. 45.8 ± 11.3 years; t=2.70, p=0.008), indicating a younger patient population in the early intervention group. Female patients constituted 57.0% of the early LC group and 49.0% of the delayed LC group; however, this difference was not statistically significant (χ^2=1.29, p=0.257). Diabetes mellitus was observed in 19.0% of patients undergoing early LC compared to 31.0% in

the delayed LC group, showing borderline statistical significance (χ^2=3.84, p=0.050). Clinical indicators of acute inflammation were more common in the early LC group, with fever at presentation reported in 63.0% versus 41.0% of patients (χ^2=9.69, p=0.002) and leukocytosis present in 71.0% versus 52.0% (χ^2=7.65, p=0.006), respectively. Despite operating during the acute inflammatory phase, successful completion of laparoscopic surgery was achieved in 93.0% of early LC patients compared with 82.0% in the delayed LC group, a statistically significant difference (χ^2=5.53, p=0.019).

Table 2. Operative parameters between early and delayed laparoscopic cholecystectomy

Variable	Early LC n=100	Delayed LC n=100	Test of significance	95% CI	p value
Operative time, minutes	67.4 ± 14.2	82.7 ± 18.6	t=6.54	-19.9 to -10.7	<0.001
Difficult Calot's dissection	29 (29.0%)	47 (47.0%)	χ^2=6.91	OR 0.46; 0.25-0.84	0.009
Dense adhesions	26 (26.0%)	54 (54.0%)	χ^2=16.34	OR 0.30; 0.16-0.56	<0.001
Gallbladder perforation	17 (17.0%)	33 (33.0%)	χ^2=6.83	OR 0.42; 0.21-0.83	0.009
Bile spillage	21 (21.0%)	38 (38.0%)	χ^2=6.94	OR 0.43; 0.23-0.82	0.008
Conversion to open surgery	7 (7.0%)	18 (18.0%)	χ^2=5.53	OR 0.34; 0.14-0.86	0.019

Table 2 presents the comparison of operative parameters between the two study groups. The mean operative time was significantly shorter in the early LC group compared to the delayed LC group (67.4 ± 14.2 minutes vs. 82.7 ± 18.6 minutes; t=6.54, p<0.001). Difficult dissection of Calot's triangle was encountered in 29.0% of patients undergoing early LC compared to 47.0% in the delayed LC group, demonstrating a significant reduction in operative difficulty with early intervention (χ^2=6.91, p=0.009). Similarly, dense adhesions were significantly less frequent in the early LC group (26.0% vs. 54.0%; χ^2=16.34, p<0.001). Intraoperative complications such as gallbladder perforation and bile spillage were also significantly lower in the early LC group, occurring in 17.0% and 21.0% of patients, respectively, compared with 33.0% and 38.0% in the delayed LC group (p=0.009 and p=0.008, respectively). Furthermore, conversion to open surgery was required in only 7.0% of early LC cases compared with 18.0% of delayed LC cases, which was statistically significant (χ^2=5.53, p=0.019).

Table 3. Postoperative outcomes between early and delayed laparoscopic cholecystectomy

Variable	Early LC n=100	Delayed LC n=100	Test of significance	95% CI	p value
Postoperative pain score at 24 hours	2.9 ± 1.1	4.8 ± 1.4	t=10.67	-2.25 to -1.55	<0.001
Postoperative complications	11 (11.0%)	27 (27.0%)	χ^2=8.32	OR 0.33; 0.16-0.72	0.004
Surgical site infection	6 (6.0%)	16 (16.0%)	χ^2=5.11	OR 0.34; 0.13-0.92	0.024

Bile leak	3 (3.0%)	9 (9.0%)	χ^2=3.27	OR 0.31; 0.08-1.18	0.071
Hospital stay, days	4.3 ± 1.2	7.1 ± 1.8	t=12.94	-3.23 to -2.37	<0.001
Recovery time, days	9.6 ± 2.7	14.8 ± 3.5	t=11.76	-6.07 to -4.33	<0.001

Table 3 compares the postoperative outcomes of patients undergoing early and delayed laparoscopic cholecystectomy. Patients in the early LC group experienced significantly lower postoperative pain scores at 24 hours than those in the delayed LC group (2.9 ± 1.1 vs. 4.8 ± 1.4; t=10.67, p<0.001). The overall postoperative complication rate was markedly lower in the early LC group, affecting 11.0% of patients compared with 27.0% in the delayed LC group (χ^2=8.32, p=0.004). Surgical site infections occurred in 6.0% of early LC patients and 16.0% of delayed LC patients, demonstrating a significant reduction in wound-related complications with early surgery (χ^2=5.11, p=0.024). Although bile leak was less common in the early LC group (3.0% vs. 9.0%), the difference did not reach statistical significance (χ^2=3.27, p=0.071). Hospital stay was significantly shorter among patients undergoing early LC, with a mean duration of 4.3 ± 1.2 days compared to 7.1 ± 1.8 days in the delayed LC group (t=12.94, p<0.001). Likewise, recovery time was significantly reduced in the early LC group (9.6 ± 2.7 days vs. 14.8 ± 3.5 days; t=11.76, p<0.001).

Table 4. Overall effectiveness and safety of early versus delayed laparoscopic cholecystectomy

Variable	Early LC n=100	Delayed LC n=100	Test of significance	95% CI	p value
Overall favourable outcome	89 (89.0%)	73 (73.0%)	χ^2=8.32	OR 3.00; 1.39-6.44	0.004
Safe completion without major complication	94 (94.0%)	84 (84.0%)	χ^2=5.09	OR 2.98; 1.11-8.00	0.024
Readmission within 30 days	4 (4.0%)	14 (14.0%)	χ^2=6.11	OR 0.26; 0.08-0.81	0.013
Need for additional intervention	5 (5.0%)	13 (13.0%)	χ^2=3.91	OR 0.35; 0.12-1.03	0.048
Patient satisfaction score	8.7 ± 1.1	7.2 ± 1.4	t=8.43	1.15 to 1.85	<0.001
Total treatment cost score	6.4 ± 1.7	8.9 ± 2.1	t=9.25	-3.03 to -1.97	<0.001

LC = laparoscopic cholecystectomy; SD = standard deviation; OR = odds ratio.

Table 4 evaluates the overall effectiveness and safety profile of early and delayed laparoscopic cholecystectomy. A favourable overall outcome was achieved in 89.0% of patients undergoing early LC compared to 73.0% of patients in the delayed LC group, representing a statistically significant advantage for early intervention (χ^2=8.32, p=0.004). Safe completion of surgery without major complications was observed in 94.0% of early LC cases and 84.0% of delayed LC cases (χ^2=5.09, p=0.024). Readmission within 30 days occurred significantly less frequently among patients who underwent early LC (4.0% vs. 14.0%; χ^2=6.11, p=0.013). Similarly, the need for additional intervention was lower in the early LC group (5.0% vs. 13.0%; χ^2=3.91, p=0.048). Patient satisfaction scores were significantly higher following early LC, with mean scores of 8.7

± 1.1 compared to 7.2 ± 1.4 in the delayed LC group (t=8.43, p<0.001). Moreover, the total treatment cost score was significantly lower among patients treated early (6.4 ± 1.7 vs. 8.9 ± 2.1; t=9.25, p<0.001), indicating better cost-effectiveness.

DISCUSSION

In the present study, patients undergoing early laparoscopic cholecystectomy (LC) were younger than those undergoing delayed LC, and female predominance was observed in both groups. Fever and leukocytosis were significantly more frequent in the early LC group, indicating that these patients were operated during the active inflammatory phase. Despite this, successful laparoscopic completion was significantly higher in the early LC group. This finding is supported by Gutt et al. (2013)[1], who reported that early LC was safe and feasible in acute cholecystitis and avoided repeated admissions. Similarly, Gurusamy et al. (2013)[2] concluded that early LC did not increase major complications and reduced total hospital stay. Current WSES guidelines by Pisano et al. (2020)[3] also recommend early LC as the standard of care whenever possible.

Operative parameters in the present study showed significantly shorter operative time in the early LC group compared with the delayed LC group. Difficult Calot's dissection, dense adhesions, gallbladder perforation, bile spillage, and conversion to open surgery were all significantly lower in early LC. These findings are comparable with Lo et al. (1998)[4], who observed that early LC was technically feasible and avoided fibrotic adhesions associated with delayed surgery. Ozkardes et al. (2014)[5] also reported that delayed surgery may be associated with dense adhesions and increased operative difficulty. Gupta et al. (2022)[6] similarly found that delayed LC had higher intraoperative difficulty, while early LC was associated with better operative outcomes.

Postoperative outcomes were also better in the early LC group. Pain score, overall complications, surgical site infection, hospital stay, and recovery time were significantly lower compared with delayed LC. Although bile leak was lower in early LC, the difference was not statistically significant. Similar observations were reported by Gurusamy et al. (2013)[2], who found no significant increase in serious complications with early LC, while total hospital stay was shorter. Borzellino et al. (2021)[7] also supported early LC, showing that earlier surgery reduced postoperative burden without increasing major adverse events. Reddy et al. (2019)[8] reported shorter hospital stay and comparable complication rates in early LC compared with delayed surgery.

Effectiveness and safety analysis showed that early LC had significantly higher favourable outcomes, safer completion without major complications, fewer readmissions, fewer additional interventions, higher patient satisfaction, and lower treatment cost score. These findings strongly support early intervention in acute calculous cholecystitis. The results are in agreement with Tokyo Guidelines 2018, which expanded the role of laparoscopic surgery in acute cholecystitis when performed with appropriate risk assessment and surgical expertise. WSES 2020 guidelines also emphasize early LC as the preferred approach, even in many high-risk groups, when feasible.

CONCLUSION

The present study demonstrated that early laparoscopic cholecystectomy is a safe, effective, and clinically superior approach compared to delayed laparoscopic cholecystectomy in patients with acute calculous cholecystitis. Patients undergoing early surgery experienced significantly shorter operative time, fewer intraoperative difficulties, lower conversion rates to open surgery, reduced

postoperative pain, fewer complications, shorter hospital stay, and faster recovery. Early laparoscopic cholecystectomy was also associated with higher rates of successful laparoscopic completion, lower readmission rates, greater patient satisfaction, and improved cost-effectiveness. These findings support the adoption of early laparoscopic cholecystectomy as the preferred treatment strategy for acute calculous cholecystitis whenever feasible and in appropriately selected patients.

LIMITATIONS OF STUDY

1. The study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other healthcare settings.
2. The cross-sectional design precluded long-term follow-up and assessment of late postoperative outcomes or recurrence of biliary symptoms.
3. Selection bias may have been present due to differences in baseline clinical characteristics and surgeon preference regarding timing of surgery.
4. Variations in surgical expertise and operative techniques among surgeons could have influenced operative and postoperative outcomes.
5. The study did not evaluate quality-of-life measures using standardized validated instruments.
6. Cost analysis was based on treatment cost scores rather than comprehensive economic evaluation of direct and indirect healthcare expenditures.
7. Potential confounding factors such as severity grading of acute cholecystitis, comorbid conditions, and duration of symptoms before presentation were not separately analyzed.
8. Larger multicentric randomized controlled studies with longer follow-up are required to further validate the findings.

REFERENCES

1. Gutt CN, Encke J, Köninger J, Harnoss JC, Weigand K, Kipfmüller K, et al. Acute cholecystitis: early versus delayed cholecystectomy, a multicenter randomized trial. Ann Surg. 2013;258(3):385-393.
2. Gurusamy KS, Samraj K. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Cochrane Database Syst Rev. 2013;(6).
3. Pisano M, Allievi N, Gurusamy K, Borzellino G, Cimbanassi S, Boerna D, et al. 2020 World Society of Emergency Surgery updated guidelines for the diagnosis and treatment of acute calculous cholecystitis. World J Emerg Surg. 2020;15(1):61.
4. Lo CM, Liu CL, Fan ST, Lai EC, Wong J. Prospective randomized study of early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Ann Surg. 1998;227(4):461-467.
5. Ozkardes AB, Tokaç M, Dumlu EG, Bozkurt B, Ciftci AB, Yetişir F, et al. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis: a prospective, randomized study. Int Surg. 2014;99(1):56-61.
6. Gupta G, Sharma A, Singh R, Verma S, Kumar P. Evaluation of early versus delayed laparoscopic cholecystectomy in acute calculous cholecystitis. Int J Surg Sci. 2022;6(2):112-117.

7. Borzellino G, De Simone B, Coccolini F, Tomasoni M, Sartelli M, Ansaloni L, et al. Timing of early laparoscopic cholecystectomy for acute calculous cholecystitis: a systematic review and meta-analysis. World J Emerg Surg. 2021;16(1):37.
8. Reddy SS, Kumar R, Prasad K, Rao MV. Comparison of early versus delayed laparoscopic cholecystectomy in acute cholecystitis: a prospective comparative study. Int Surg J. 2019;6(8):2754-2759.