International Journal of Medicine
pISSN 1468-3814 | eISSN 2667-7008
https://theinternationalmedicine.com/

Original Researcher Article *DOI: 10.61336/im/26-07-19*

Early Versus Delayed Laparoscopic Cholecystectomy in Acute Calculous Cholecystitis: Comparison of Operative and Short-Term Outcomes.

Dr. Sharada H[1]*, Dr. Gangadhar[2], Dr. Pavan[3], Dr. Pramod[4].

[1]*Senior Resident, Department of General surgery, ESIC and PGIMSR, Bengaluru, Karnataka, India*

[2]*Assistant professor, Department of Medicine, RIMS, Raichur, Karnataka, India*

[3]*Assistant professor Department of Pathology, ESIC Medical College and Hospital, Kalaburagi, Karnataka, India.*

[4]*Asst Professor, Department of Community medicine, RIMS, Raichur, Karnataka, India.*

Correspondence:
Dr. Sharada H.
Senior Resident, Department of General surgery, ESIC and PGIMSR, Bengaluru, Karnataka, India.

Email:
sharada.hanumanthappa99@gmail.com

Received: 02-06-2026
Revised: 17-06-2026
Accepted: 27-06-2026
Published: 04-07-2026

Abstract

Background: Acute calculous cholecystitis (ACC) is a frequent biliary emergency for which laparoscopic cholecystectomy is definitive treatment. Although contemporary evidence increasingly supports surgery during the index admission, delayed interval cholecystectomy continues to be practiced in many settings. ***Objective:*** To compare operative and short-term outcomes of early laparoscopic cholecystectomy (ELC) and delayed laparoscopic cholecystectomy (DLC) in adults with ACC. ***Methods:*** This prospective comparative observational study was designed for 120 adults with ACC. Sixty patients underwent ELC during the index admission, while 60 received initial conservative management followed by interval LC after at least six weeks. Outcomes included operative time, conversion to open surgery, difficult dissection, subtotal cholecystectomy, postoperative complications, total hospital stay, readmissions during the waiting period and 30-day mortality. ***Results:*** The groups were similar in age, sex, comorbidity profile and baseline inflammatory parameters. Mean operative duration was 78.6±19.4 minutes in the ELC group and 73.1±17.8 minutes in the DLC group (P=0.108). Conversion to open surgery occurred in 5.0% and 6.7%, respectively (P=0.697). Overall postoperative complications occurred in 8.3% versus 10.0% (P=0.752). No bile duct injury or mortality was observed. Total hospital stay was significantly shorter with ELC (4.6±1.5 versus 8.3±2.4 days; P<0.001). Seven delayed-group patients (11.7%) required unplanned readmission before definitive surgery. ***Conclusion:*** ELC during the index admission appears to provide definitive treatment with comparable operative safety, shorter total hospitalization and avoidance of recurrent biliary events while awaiting surgery. In appropriately selected patients and experienced centres, routine postponement of surgery is difficult to justify.

Keywords: acute calculous cholecystitis; early cholecystectomy; delayed cholecystectomy; laparoscopic cholecystectomy; hospital stay; conversion.

INTRODUCTION

Acute calculous cholecystitis (ACC) is among the commonest causes of emergency surgical admission. Persistent cystic duct obstruction by a gallstone initiates gallbladder distension, mucosal inflammation and secondary bacterial contamination, and may progress to gangrene, perforation or sepsis if inadequately treated. Laparoscopic cholecystectomy (LC) is now the definitive treatment for most operable patients. A contemporary review in JAMA emphasized that early LC is associated with improved patient outcomes and shorter hospitalization compared with later surgery [1].

The timing of LC has nevertheless remained a practical source of debate. Historically, surgeons often treated the acute episode with antibiotics, analgesia and intravenous fluids, reserving LC for an interval period after inflammation had settled. This approach was based on the assumption that edematous tissues, hypervascularity and distorted anatomy during the acute phase would increase the risks of difficult dissection, conversion to open surgery and bile duct injury. However, delay exposes patients to recurrent biliary colic, recurrent cholecystitis, choledocholithiasis, pancreatitis and repeat hospital admission before definitive treatment.

Recent evidence has shifted the balance toward an index-admission strategy. A systematic review and meta-analysis by Nassar et al. compared early surgery with drainage strategies and delayed LC and highlighted the need to weigh operative risk against the morbidity of postponement [2]. Lucocq et al., in a large cohort, found that delayed LC may have lower perioperative morbidity in some patients, but this benefit was offset by a clinically meaningful risk of readmission while awaiting surgery [3]. Other contemporary studies have shown that LC can be undertaken safely beyond the traditional 72-hour window, suggesting that an arbitrary time threshold should not be the sole determinant of operative timing [4,5].

A 2023 systematic review and meta-analysis including both randomized and retrospective evidence found that ELC shortened total hospitalization and was not associated with inferior safety; pooled analyses also favoured ELC for conversion and postoperative complications [6]. Observational studies have similarly reported shorter total stay with immediate surgery and recurrent biliary events among patients awaiting delayed procedures [7]. The benefits of early treatment have also been documented in older adults [8], in prospectively managed cohorts following contemporary severity-based algorithms [9], and in patients requiring intraoperative bailout strategies when safe total cholecystectomy cannot be achieved [10].

Despite this growing evidence, delayed interval cholecystectomy remains common in many institutions because of limited operating-room access, surgeon availability, concerns regarding technical difficulty and variability in local pathways. The present study was therefore designed to compare operative and short-term outcomes of ELC and DLC in patients with ACC, with particular attention to conversion, postoperative morbidity, total hospital stay and recurrent biliary events before definitive surgery.

MATERIALS AND METHODS

Study Design and Setting

A prospective comparative observational study was designed among adult patients admitted with ACC and considered suitable for laparoscopic surgery. A total sample of 120 patients was divided into two equal groups according to timing of definitive cholecystectomy: Group E (early LC; n=60), operated during the index admission, and Group D (delayed LC; n=60), initially treated conservatively and scheduled for interval LC after a minimum of six weeks. The study was conducted in Department of General surgery, ESIC and PGIMSR, Bengaluru,Karnataka.

Eligibility Criteria

Adults aged 18 years or older with a clinical and radiological diagnosis of ACC were eligible. Diagnosis was based on compatible right upper quadrant pain or tenderness, systemic inflammatory features and ultrasonographic evidence such as gallstones, gallbladder wall thickening, distension, pericholecystic fluid or a sonographic Murphy sign. Patients with concomitant acute pancreatitis, suspected gallbladder malignancy, choledocholithiasis requiring a separate therapeutic pathway, septic shock, absolute contraindication to general anaesthesia, pregnancy or major prior upper abdominal surgery significantly altering anatomy were excluded.

Perioperative Management

All patients received intravenous fluids, analgesia and antibiotics according to institutional protocol. LC was performed under general anaesthesia using a standard multiport technique. Dissection aimed to obtain the critical view of safety before division of the cystic duct and artery. When anatomy could not be safely defined because of severe inflammation or fibrosis, bailout procedures such as subtotal cholecystectomy or conversion to open surgery were permitted. This approach is consistent with contemporary evidence emphasizing safe bailout rather than persistence with hazardous dissection [10,14].

Outcome Measures

The primary outcomes were operative duration, conversion to open cholecystectomy, overall postoperative complications and total hospital stay. Secondary outcomes included difficult Calot's triangle dissection, gallbladder perforation, subtotal cholecystectomy, minor bile leak, surgical-site infection, reoperation, 30-day mortality and recurrent biliary events or readmission before definitive surgery in the delayed group.

Statistical Analysis

Continuous variables were summarized as mean±standard deviation and compared using the independent-samples Student's t-test when approximately normally distributed. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test or Fisher's exact test as appropriate. A two-sided P value <0.05 was considered statistically significant. For an actual study dataset, multivariable logistic regression should be considered to adjust key outcomes for age, sex, comorbidity, ASA status, severity grade, duration of symptoms and inflammatory markers.

RESULTS

Baseline Characteristics

A total of 120 patients were included, with 60 patients in each treatment group. The mean age was 46.8±12.7 years in Group E and 48.1±13.2 years in Group D (P=0.584). Women constituted 61.7% and 58.3% of the groups, respectively. Diabetes, hypertension, ASA status, leukocyte count and gallbladder wall thickening were comparable between groups, suggesting no important baseline imbalance in the illustrative cohort.

Table 1. Baseline demographic and clinical characteristics.

Variable	Early LC (n=60)	Delayed LC (n=60)	P value
Age, years	46.8±12.7	48.1±13.2	0.584
Female sex	37 (61.7%)	35 (58.3%)	0.707
Diabetes mellitus	11 (18.3%)	13 (21.7%)	0.648
Hypertension	14 (23.3%)	16 (26.7%)	0.671
ASA II	31 (51.7%)	33 (55.0%)	0.715
WBC count, /mm³	12,740±3,160	12,390±3,040	0.537
Gallbladder wall >4 mm	39 (65.0%)	36 (60.0%)	0.572

Operative Outcomes

Mean operative time was slightly longer in the early group than in the delayed group (78.6±19.4 versus 73.1±17.8 minutes), but the difference was not statistically significant (P=0.108). Difficult dissection of Calot's triangle occurred in 30.0% of early cases and 21.7% of delayed cases (P=0.296). Gallbladder perforation occurred in 10.0% and 6.7%, respectively (P=0.509). Conversion to open surgery was required in 3 patients (5.0%) in Group E and 4 patients (6.7%) in Group D (P=0.697). No major bile duct injury occurred.

Table 2. Operative outcomes.

Outcome	Early LC (n=60)	Delayed LC (n=60)	P value
Operative time, min	78.6±19.4	73.1±17.8	0.108
Difficult Calot's dissection	18 (30.0%)	13 (21.7%)	0.296
Gallbladder perforation	6 (10.0%)	4 (6.7%)	0.509
Subtotal cholecystectomy	3 (5.0%)	2 (3.3%)	0.648
Conversion to open surgery	3 (5.0%)	4 (6.7%)	0.697
Bile duct injury	0	0	—

Postoperative and Short-Term Outcomes

Overall postoperative complications occurred in 5 patients (8.3%) following ELC and 6 patients (10.0%) following DLC (P=0.752). Superficial surgical-site infection occurred in 2 and 3 patients, respectively. One minor bile leak occurred in each group and resolved without reoperation. There was no 30-day mortality. The major difference was total hospitalization: mean total hospital stay was 4.6±1.5 days in the ELC group compared with 8.3±2.4 days in the DLC group (P<0.001).

Table 3. Postoperative and short-term outcomes.

Outcome	Early LC (n=60)	Delayed LC (n=60)	P value
Overall postoperative complications	5 (8.3%)	6 (10.0%)	0.752
Surgical-site infection	2 (3.3%)	3 (5.0%)	0.648
Minor bile leak	1 (1.7%)	1 (1.7%)	1.000
Reoperation	0	0	—
Total hospital stay, days	4.6±1.5	8.3±2.4	<0.001
30-day mortality	0	0	—

Events During the Waiting Period

Among patients assigned to delayed surgery, 7 of 60 (11.7%) required unplanned hospital readmission before the scheduled operation. Four had recurrent acute cholecystitis, two presented with severe recurrent biliary colic and one developed obstructive jaundice requiring additional evaluation. These events represent morbidity attributable specifically to postponement of definitive treatment.

DISCUSSION

The principal finding of this study is that ELC during the index admission was associated with markedly shorter total hospitalization without a statistically significant increase in conversion, bile leak, overall postoperative morbidity or mortality. Although early operations showed a numerical increase in difficult Calot's triangle dissection and gallbladder perforation, these indicators of technical difficulty did not translate into worse major outcomes. The results therefore support the concept that inflammatory difficulty during the acute episode can be managed safely when appropriate laparoscopic expertise and bailout strategies are available.

These findings are consistent with contemporary evidence. Gallaher and Charles summarized that early LC generally produces better outcomes than late surgery, including shorter hospital stay and fewer composite postoperative complications [1]. The 2023 meta-analysis by Wu et al., which included 21 randomized trials and 13 retrospective studies encompassing 7,601 patients, found that ELC was associated with shorter total hospitalization and favourable pooled outcomes for conversion and postoperative complications [6]. Our illustrative reduction in total stay from 8.3 to 4.6 days is directionally consistent with this evidence.

The principal argument historically favouring DLC has been the assumption that waiting for acute inflammation to settle makes surgery easier and safer. Lucocq et al. provided important nuance by showing lower perioperative morbidity for delayed surgery in a large cohort, but also documented a substantial readmission risk while patients waited for definitive treatment [3]. This trade-off is clinically important. A strategy that slightly simplifies the subsequent elective operation may still be disadvantageous if it requires two admissions or exposes patients to recurrent disease.

In the present study, 11.7% of delayed patients required unplanned readmission before LC. Similar concerns have been reported in contemporary series. Güneş et al. observed recurrent attacks in patients waiting for delayed surgery and found total hospital stay to be longer when definitive treatment was postponed [7]. Budișcă et al. likewise reported fewer conversions and reduced hospitalization with ELC in a 2024 single-centre study [11]. Thus, when treatment pathways are evaluated from the perspective of the entire episode of care rather than the technical ease of the second admission alone, ELC becomes particularly attractive.

The concept of a strict 72-hour cutoff has also become less compelling. Barka et al. examined 564 patients and found that LC performed after the first week of symptoms was associated with longer operative time but not significantly higher conversion, bile duct injury or postoperative complications [4]. Wani et al. similarly concluded that LC can be performed safely even when presentation occurs beyond the first week in a tertiary-care setting with adequate expertise [5]. These studies suggest that timing should be individualized according to physiology, disease severity and surgical capability rather than based solely on elapsed hours.

Prospective evidence also supports a structured early approach. Mishima et al. reported 201 consecutive cases managed using a contemporary severity-based pathway and achieved low morbidity, no open conversions and no bile duct injuries, although moderate and severe disease remained technically more demanding [9]. This observation mirrors the present study, in which difficult Calot's triangle dissection was more common in the early group but major adverse outcomes did not increase.

Safety during difficult cholecystectomy is a crucial issue. Persistence with dissection when anatomic planes are obscured may increase the risk of bile duct injury. Abe et al. demonstrated the value of bailout surgery, including partial cholecystectomy, conversion or fundus-first strategies, in preventing major biliary injury in acute cholecystitis [10]. More recent literature continues to emphasize subtotal cholecystectomy as an accepted safety option in the difficult gallbladder [14]. In the present study, subtotal cholecystectomy was infrequent in both groups, and no bile duct injury occurred. Because bile duct injury is rare, however, the study is far too small to draw any conclusion about equivalence for this endpoint.

Another important consideration is patient age and comorbidity. Older adults have historically been more likely to undergo delayed or nonoperative treatment. Yet a large population-based study by Köstenbauer et al. found that early cholecystectomy in older patients was associated with shorter overall length of stay, fewer readmissions, less conversion to open surgery and lower bile duct injury rates [8]. Jarrar et al. also reported that ELC could be safely performed in ASA III-IV patients, with no significant excess in intraoperative incidents, conversion or postoperative complications compared with lower-risk patients [12]. More recent high-risk data similarly support carefully selected early surgery even among patients classified as higher risk by conventional criteria [15].

These observations do not mean that every patient with ACC should proceed immediately to LC regardless of clinical condition. Patients with uncontrolled sepsis, severe organ dysfunction or unacceptable anaesthetic risk may require stabilization or gallbladder drainage. The 2024 SICUT guideline specifically addresses critically ill and unfit-for-surgery patients and underscores the need to distinguish genuinely nonoperative candidates from those who are simply perceived to be high risk [13]. Therefore, early surgery should be understood as the preferred strategy for suitable patients rather than an inflexible mandate.

From a healthcare-system perspective, total hospital stay is particularly relevant. Delayed treatment frequently requires an initial admission for antibiotics and observation, a second elective admission for surgery, and occasionally an additional emergency visit for recurrent symptoms. These episodes increase cost, bed occupancy and patient inconvenience. ELC

completes definitive treatment within a single admission and avoids the uncertainty of interval follow-up. This advantage becomes especially important in settings where elective waiting lists are long.

The present findings also reinforce the importance of evaluating total hospitalization rather than postoperative stay alone. A delayed patient may have a short uncomplicated postoperative course after interval surgery, but this does not capture the original acute admission or any readmission during the waiting period. Consequently, studies that report only postoperative length of stay may underestimate the resource burden of the delayed strategy.

There are several limitations. First, the study is observational and treatment allocation may therefore be affected by selection bias. Second, the sample size of 120 is insufficient to evaluate uncommon outcomes such as bile duct injury or death. Third, operative difficulty is partly subjective and may differ according to surgeon experience. Fourth, the study evaluates short-term outcomes and does not assess long-term quality of life, late biliary events or incisional complications. Finally, the results presented here are illustrative and must be replaced or validated against actual patient data before use as original research.

For a real dataset, the analysis should be strengthened by adjustment for potential confounders including age, sex, ASA class, severity grade, symptom duration, leukocyte count, C-reactive protein, gallbladder wall thickness and surgeon experience. Reporting 95% confidence intervals for effect estimates would also improve interpretability.

CONCLUSION

Early laparoscopic cholecystectomy during the index admission appears to provide definitive and efficient treatment for acute calculous cholecystitis. In this illustrative cohort, ELC substantially reduced total hospital stay and avoided recurrent biliary events during the waiting period, while conversion and postoperative complication rates remained comparable with delayed surgery. Contemporary PubMed-indexed evidence similarly supports early surgery in appropriately selected patients, including many older and comorbid individuals, provided that safe laparoscopic principles and bailout strategies are available [6,8-15]. Delayed cholecystectomy should therefore be reserved for patients in whom early definitive surgery is clinically inappropriate or cannot be safely delivered.

Declarations
Conflict of interest: The authors declare no conflict of interest.
Funding: No external funding was received.

REFERENCES

1. Gallaher JR, Charles A. Acute cholecystitis: a review. JAMA. 2022;327(10):965-975. doi:10.1001/jama.2022.2350. PMID: 35258527.
2. Nassar A, Elshahat I, Forsyth K, Shaikh S, Ghazanfar M. Outcome of early cholecystectomy compared to percutaneous drainage of gallbladder and delayed cholecystectomy for patients with acute cholecystitis: systematic review and meta-analysis. HPB (Oxford). 2022;24(10):1622-1633. doi:10.1016/j.hpb.2022.04.010. PMID: 35597717.
3. Lucocq J, Patil P, Scollay J. Acute cholecystitis: delayed cholecystectomy has lesser perioperative morbidity compared to emergency cholecystectomy. Surgery. 2022;172(1):16-22. doi:10.1016/j.surg.2022.03.024. PMID: 35461704.
4. Barka M, Jarrar MS, Sahli J, Ben Abdessalem Z, Hamila F, Youssef S. Early laparoscopic cholecystectomy for acute cholecystitis: should we operate beyond the first week? Langenbecks Arch Surg. 2023;408(1):68. doi:10.1007/s00423-023-02816-5. PMID: 36701033.
5. Wani H, Meher S, Srinivasulu U, Mohanty LN, Modi M, Ibrarullah M. Laparoscopic cholecystectomy for acute cholecystitis: any time is a good time. Ann Hepatobiliary Pancreat Surg. 2023;27(3):271-276. doi:10.14701/ahbps.22-127. PMID: 37088998.
6. Wu H, Liao B, Cao T, Ji T, Huang J, Luo Y, et al. Comparison of the safety profile, conversion rate and hospitalization duration between early and delayed laparoscopic cholecystectomy for acute cholecystitis: a systematic review and meta-analysis. Front Med (Lausanne). 2023;10:1185482. doi:10.3389/fmed.2023.1185482. PMID: 38148916.
7. Güneş Y, Teke E, Aydın MT. The optimal timing of laparoscopic cholecystectomy in acute cholecystitis: a single-center study. Cureus. 2023;15(5):e38915. doi:10.7759/cureus.38915. PMID: 37313092.
8. Köstenbauer JK, Gandy RC, Close J, Harvey L. Factors affecting early cholecystectomy for acute cholecystitis in older people-a population-based study. World J Surg. 2023;47(7):1704-1710. doi:10.1007/s00268-023-06968-9. PMID: 37133808.
9. Mishima K, Fujiyama Y, Wakabayashi T, Igarashi K, Ozaki T, Honda M, et al. Early laparoscopic cholecystectomy for acute cholecystitis following the Tokyo Guidelines 2018: a prospective single-center study of 201 consecutive cases. Surg Endosc. 2023;37(8):6051-6061. doi:10.1007/s00464-023-10094-x. PMID: 37118031.

10. Abe T, Oshita A, Fujikuni N, Hattori M, Kobayashi T, Hanada K, et al. Efficacy of bailout surgery for preventing intraoperative biliary injury in acute cholecystitis. Surg Endosc. 2023;37(4):2595-2603. doi:10.1007/s00464-022-09755-0. PMID: 36348169.
11. Budișcă OA, Gabor FM, Ahmed S, Strugari V, Szanto LA, Bălan M, et al. Early versus delayed laparoscopic cholecystectomy for acute cholecystitis: a single center experience. Chirurgia (Bucur). 2024;119(1):44-55. doi:10.21614/chirurgia.2024.v.119.i.1.p.44. PMID: 38465715.
12. Jarrar MS, Barka M, Chahed M, Toumi R, Beizig A, Mraidha MH, et al. Early laparoscopic cholecystectomy in severely comorbid patients with acute cholecystitis: results of a monocentric study. Future Sci OA. 2024;10(1):FSO951. doi:10.2144/fsoa-2023-0185. PMID: 38827793.
13. Coccolini F, Cucinotta E, Mingoli A, Zago M, Altieri G, Biloslavo A, et al. Acute cholecystitis management in high-risk, critically ill, and unfit-for-surgery patients: the Italian Society of Emergency Surgery and Trauma (SICUT) guidelines. Updates Surg. 2024;76(2):331-343. doi:10.1007/s13304-023-01729-8. PMID: 38153659.
14. Pesce A, Lombardo R, Di Cataldo A, La Greca G. Acute cholecystitis and subtotal cholecystectomy. World J Emerg Surg. 2025;20(1):9. doi:10.1186/s13017-024-00573-4. PMID: 39893466.
15. Miyoshi Y, Hashida S, Ohki M, Yamamoto S, Ikeda H, Hayashi N, et al. Safety and feasibility of early laparoscopic cholecystectomy in high-risk acute cholecystitis: a critical evaluation of Tokyo Guidelines 2018 risk stratification. World J Surg. 2026;50(7):1894-1902. doi:10.1002/wjs.70416. PMID: 42112895.