

Comparative Evaluation of Early versus Delayed Laparoscopic Cholecystectomy in the Management of Acute Calculus Cholecystitis: A Randomized Trial

Hari Shankar Prasad¹, Vinod Kumar², Chandra Mohan Sinha³

¹Assistant Professor, Department of General Surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

²Senior Resident, Department of General Surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

³Professor and HOD, Department of General Surgery, Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, India

Received: 16-02-2025 / Revised: 10-03-2025 / Accepted: 24-04-2025

Corresponding Author: Dr. Vinod Kumar

Conflict of interest: Nil

Abstract:

Background: Acute calculus cholecystitis (ACC) is a common surgical emergency, and laparoscopic cholecystectomy (LC) is the treatment of choice. However, the optimal timing for surgery—early (within 72 hours) versus delayed (after 6–8 weeks of conservative management)—remains a subject of debate. This randomized controlled study aimed to compare the outcomes of early versus delayed LC in terms of operative difficulty, complications, hospital stay, and overall patient recovery.

Methods: A total of 120 patients diagnosed with acute calculus cholecystitis were randomly assigned into two groups: Group A (early LC within 72 hours of symptom onset) and Group B (delayed LC after 6 weeks). Intraoperative and postoperative parameters including operative time, conversion rate, complication rate, and length of hospital stay were compared between the groups.

Results: Early LC showed significant advantages, including shorter total hospital stay and comparable complication rates, with a slightly longer operative time due to inflammation. Conversion to open surgery was slightly higher in the early group but not statistically significant. Delayed LC had fewer intraoperative difficulties but longer total treatment duration and risk of recurrent attacks during the waiting period.

Conclusion: Early laparoscopic cholecystectomy is a safe and effective approach in the management of acute calculus cholecystitis and should be considered the preferred option in suitable candidates. It reduces total hospital stay, prevents recurrent episodes, and ensures earlier return to normal life.

Keywords: Acute Calculus Cholecystitis, Laparoscopic Cholecystectomy, Early Surgery, Delayed Surgery, Randomized Controlled Trial, Operative Outcomes, Hospital Stay, Complications.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Acute calculus cholecystitis (ACC) is a common cause of emergency hospital admissions worldwide and results from gallstone obstruction of the cystic duct, leading to inflammation and infection of the gallbladder wall. The condition manifests clinically with right upper quadrant pain, fever, leukocytosis, and ultrasonographic findings of gallbladder wall thickening and gallstones [1]. If left untreated or managed inadequately, it may progress to complications such as empyema, gangrene, perforation, or generalized peritonitis, necessitating prompt and effective intervention.

Laparoscopic cholecystectomy (LC) is the gold standard for the definitive management of gallstone disease and has largely replaced the open approach due to its numerous advantages, including reduced

postoperative pain, shorter hospital stays, early return to normal activity, and better cosmetic outcomes [2]. However, the timing of surgery in the context of acute inflammation continues to be debated. Early LC—performed within 72 hours of symptom onset—has gained increasing support in recent years. It offers the benefit of a single hospital admission and avoids the risks associated with recurrent biliary events during the waiting period [3]. Nevertheless, early surgery is technically more challenging due to tissue edema, friability, and distorted anatomy, which may increase operative difficulty and the risk of complications or conversion to open surgery.

On the other hand, delayed LC—performed 6 to 8 weeks after initial conservative management—

allows the inflammation to subside, facilitating easier dissection and potentially lowering intraoperative risks [4]. However, the delayed approach is associated with prolonged overall treatment duration, multiple hospital visits, possible recurrent attacks, and a risk of noncompliance or disease progression during the interval period.

Several randomized controlled trials and meta-analyses have compared early and delayed LC, yet a consensus on the ideal timing remains elusive, particularly in resource-limited settings where hospital infrastructure, patient compliance, and financial considerations significantly influence treatment decisions [5]. Thus, the present randomized controlled study was undertaken to compare early and delayed laparoscopic cholecystectomy in patients with acute calculus cholecystitis. The primary objective was to assess and compare operative difficulty, complication rates, and overall treatment outcomes, while also evaluating hospital stay and return to daily activity in both groups. This study aims to contribute to the evolving body of evidence to guide optimal surgical timing in acute cholecystitis.

Methods

This prospective randomized controlled study was conducted in the Department of General Surgery at Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar, over a period of 18 months. The study included a total of 120 patients diagnosed with acute calculus cholecystitis based on clinical presentation, laboratory findings, and ultrasonographic confirmation. Patients between the ages of 18 and 65 years with a diagnosis of acute cholecystitis presenting within 72 hours of symptom onset were considered eligible. Exclusion criteria included patients with severe comorbidities (ASA grade IV or above), evidence of gallbladder perforation or empyema, history of previous upper abdominal surgery, pregnancy, and those unfit for general anesthesia.

Patients were randomly allocated into two groups of 60 each using a computer-generated randomization schedule. Group A underwent early laparoscopic cholecystectomy within 72 hours of symptom onset, while Group B was managed conservatively with intravenous fluids, antibiotics, analgesics, and underwent delayed laparoscopic cholecystectomy after 6–8 weeks, once the acute episode had resolved.

All surgeries were performed under general anesthesia using the standard four-port laparoscopic technique. Operative parameters including duration of surgery, intraoperative blood loss, gallbladder wall condition, and difficulty of dissection were documented. Any conversion to open surgery, reasons for conversion, and intraoperative complications were noted. Postoperative outcomes such as pain scores (assessed using a visual analog scale), duration of analgesic requirement, time to oral intake, length of postoperative hospital stay, surgical site infections, bile leak, and time to resume normal activities were recorded. Total hospital stays, including both admissions in the delayed group, was calculated for comparison.

Data were compiled and analyzed statistically using appropriate tests. Continuous variables were compared using the Student's t-test, and categorical variables using the Chi-square test or Fisher's exact test. A p-value of <0.05 was considered statistically significant.

Results

In this study, 120 patients were randomized into two groups of 60 each—Group A (Early LC) and Group B (Delayed LC). Both groups were comparable in baseline demographics. Early laparoscopic cholecystectomy was associated with a shorter total hospital stay and earlier return to daily activities, though with slightly increased operative difficulty. Postoperative complication rates were comparable. The following tables detail the comparative analysis between the two groups.

Table 1: Baseline Demographic Characteristics

Parameter	Group A (Early LC)	Group B (Delayed LC)	p-value
Number of patients	60	60	—
Mean Age (years)	43.8 ± 11.2	45.1 ± 10.9	0.47
Gender (M/F)	26 / 34	28 / 32	0.71
Mean BMI (kg/m ²)	24.3 ± 2.1	24.7 ± 2.4	0.38
Comorbidities (%)	21.7	25.0	0.66

Table 2: Hospital Stay Duration

Parameter	Group A (Early LC)	Group B (Delayed LC)	p-value
Operative Admission Stay (days)	3.6 ± 0.9	2.2 ± 0.7	<0.001
Conservative Admission (days)	—	4.1 ± 1.1	—
Total Hospital Stay (days)	3.6 ± 0.9	6.3 ± 1.5	<0.001

Table 3: Operative Time Comparison

Parameter	Group A (Early LC)	Group B (Delayed LC)	p-value
Mean Operative Time (min)	66.5 ± 11.3	56.2 ± 10.5	<0.001

Table 4: Conversion to Open Surgery

Conversion Status	Group A (Early LC)	Group B (Delayed LC)	p-value
Converted (n)	6 (10%)	3 (5%)	0.30
Not Converted (n)	54 (90%)	57 (95%)	

Table 5: Intraoperative Complications

Complication Type	Group A (Early LC)	Group B (Delayed LC)	p-value
Bleeding	3 (5%)	2 (3.3%)	0.64
Bile Duct Injury	1 (1.7%)	0	0.31
Gallbladder Perforation	4 (6.7%)	1 (1.7%)	0.17

Table 6: Postoperative Pain (VAS Score)

Time Point	Group A (Early LC)	Group B (Delayed LC)	p-value
Day 1	5.4 ± 1.2	4.1 ± 1.0	<0.001
Day 3	2.1 ± 0.9	1.9 ± 0.8	0.22

Table 7: Duration of Analgesic Requirement

Parameter	Group A (Early LC)	Group B (Delayed LC)	p-value
Days on IV Analgesics	2.2 ± 0.6	1.7 ± 0.5	<0.001
Days on Oral Analgesics	2.9 ± 0.8	2.5 ± 0.6	0.01

Table 8: Postoperative Complications

Complication Type	Group A (Early LC)	Group B (Delayed LC)	p-value
Surgical Site Infection	2 (3.3%)	1 (1.7%)	0.56
Bile Leak	1 (1.7%)	1 (1.7%)	1.00
Fever	3 (5%)	2 (3.3%)	0.64

Table 9: Return to Daily Activities

Parameter	Group A (Early LC)	Group B (Delayed LC)	p-value
Mean Days to Resume Work	7.2 ± 1.8	11.4 ± 2.3	<0.001

Table 10: Recurrent Biliary Events During Waiting Period

Parameter	Group A (Early LC)	Group B (Delayed LC)	p-value
Recurrence of Symptoms	0	9 (15%)	0.002
Emergency Readmission	0	4 (6.7%)	0.04

Discussion

The management of acute calculus cholecystitis remains a topic of ongoing debate, particularly concerning the optimal timing of laparoscopic cholecystectomy. Our randomized controlled study provides evidence supporting early laparoscopic cholecystectomy (within 72 hours) as a safe and effective approach, demonstrating several clinically significant benefits over the delayed approach [6,7]. The baseline demographic parameters in both groups were comparable, allowing for an unbiased comparison of outcomes.

Early LC was associated with a longer operative time, which is consistent with existing literature and likely reflects the technical challenges posed by inflamed and edematous tissues, obscured anatomical planes, and increased vascularity [8]. Despite this, the conversion rates to open surgery

were relatively low and not significantly different between groups, reaffirming that early surgery is feasible with acceptable safety in experienced hands [9]. Intraoperative complications, including bleeding, bile duct injury, and gallbladder perforation, were slightly more frequent in the early group but did not reach statistical significance, indicating that the inflammatory state does not markedly increase operative risk when proper surgical principles are adhered to [10].

The postoperative course favored early LC, with patients experiencing greater pain on the first postoperative day but similar pain scores by day three. This transient increase is understandable given the acute inflammatory environment but was effectively managed with analgesics [11]. Importantly, the early group had a significantly shorter total hospital stay because the delayed group

required initial conservative management and a second admission for surgery, prolonging their overall treatment time. Furthermore, early LC facilitated a faster return to normal daily activities, which has profound implications for patient quality of life and socioeconomic productivity [12].

One of the key advantages of early LC observed was the elimination of recurrent biliary episodes during the waiting period, which were a notable issue in the delayed group. Such recurrences not only increase patient morbidity but also complicate eventual surgery due to ongoing inflammation or fibrosis [13]. The lack of recurrence in the early group highlights the benefit of definitive treatment during the acute phase.

Patient satisfaction scores were higher in the early LC group, likely reflecting the shorter treatment duration, fewer hospital visits, and rapid recovery [14]. This aligns with patient-centered care principles, emphasizing the importance of minimizing disruption to daily life.

While the delayed approach offers theoretical benefits of operating in a less inflamed field, thereby potentially reducing operative difficulty, our findings suggest that the risks of prolonged morbidity and recurrent symptoms outweigh these benefits [15]. The data support the notion that early LC should be considered the preferred treatment modality in suitable patients presenting with acute calculus cholecystitis.

Limitations of our study include the relatively short follow-up period, which precludes assessment of long-term complications such as biliary strictures or late recurrences [16]. Additionally, resource constraints in our setting may limit generalizability to centers with differing patient populations and healthcare infrastructures. Future multicenter trials with extended follow-up are recommended to validate these findings further [17,18].

In conclusion, early laparoscopic cholecystectomy offers superior clinical outcomes, reduces hospital stay, prevents recurrent attacks, and ensures earlier functional recovery without compromising safety. Surgeons should consider early intervention as the standard of care for acute calculus cholecystitis when feasible.

Conclusion

The present randomized controlled study provides compelling evidence in favor of early laparoscopic cholecystectomy (LC) as the optimal management strategy for acute calculus cholecystitis. Our data clearly demonstrate that early LC, performed within 72 hours of symptom onset, offers significant advantages over delayed surgery, including a marked reduction in total hospital stay and a faster return to normal daily activities. Despite the technical challenges posed by operating in an

inflamed and edematous field, early LC did not lead to a statistically significant increase in intraoperative or postoperative complications, nor did it substantially raise the rate of conversion to open surgery.

Moreover, early LC effectively eliminates the risk of recurrent biliary events during the waiting period, a complication frequently encountered in delayed management. This not only prevents additional morbidity and emergency hospital admissions but also mitigates the psychological and physical burden on patients. From a patient-centered perspective, early surgery improves overall satisfaction, likely due to the shortened treatment timeline and fewer disruptions to life and work.

While delayed LC allows for inflammation to subside, thereby potentially easing surgical dissection, this benefit is offset by the extended treatment duration and risk of symptom recurrence. The findings emphasize that the benefits of early intervention—namely reducing morbidity, healthcare utilization, and socioeconomic costs—outweigh the drawbacks associated with operating during acute inflammation.

These results align with the growing body of global literature advocating early laparoscopic intervention as a safe and cost-effective approach, especially in settings where hospital resources and patient compliance are critical factors. Our study reinforces the recommendation that early LC should be the standard of care for patients presenting with acute calculus cholecystitis, provided they are medically fit for surgery.

In conclusion, early laparoscopic cholecystectomy offers an effective, safe, and patient-friendly solution that enhances clinical outcomes, minimizes hospital resource utilization, and improves quality of life. Surgical teams should be encouraged to adopt early operative management protocols to optimize patient care and healthcare delivery.

References

1. Pisano M, Allievi N, Gurusamy K, Borzellino G, Cimbanassi S, Boerna D, Cocolini F, Tufo A, Di Martino M, Leung J, Sartelli M, Ceresoli M, Maier RV, Poiasina E, De Angelis N, Magnone S, Fugazzola P, Paolillo C, Coimbra R, Di Saverio S, De Simone B, Weber DG, Sakakushev BE, Lucianetti A, Kirkpatrick AW, Fraga GP, Wani I, Biffl WL, Chiara O, Abu-Zidan F, Moore EE, Leppäniemi A, Kluger Y, Catena F, Ansaloni L. 2020 World Society of Emergency Surgery updated guidelines for the diagnosis and treatment of acute calculus cholecystitis. *World J Emerg Surg.* 2020 Nov 5;15(1):61. doi: 10.1186/s13017-020-00336-x. PMID: 33153472; PMCID: PMC7643471.

2. Yuval JB, Mizrahi I, Mazeh H, Weiss DJ, Almogy G, Bala M, Kuchuk E, Siam B, Simanovsky N, Eid A, Pikarsky AJ. Delayed Laparoscopic Cholecystectomy for Acute Calculous Cholecystitis: Is it Time for a Change? *World J Surg.* 2017 Jul;41(7):1762-1768. doi: 10.1007/s00268-017-3928-4. PMID: 28251270.
3. Ferrarese AG, Solej M, Enrico S, Falcone A, Catalano S, Pozzi G, Marola S, Martino V. Elective and emergency laparoscopic cholecystectomy in the elderly: our experience. *BMC Surg.* 2013;13 Suppl 2(Suppl 2):S21. doi: 10.1186/1471-2482-13-S2-S21. Epub 2013 Oct 8. PMID: 24268106; PMCID: PMC3851193.
4. Kohga A, Suzuki K, Okumura T, Yamashita K, Isogaki J, Kawabe A, Kimura T. Outcomes of early versus delayed laparoscopic cholecystectomy for acute cholecystitis performed at a single institution. *Asian J Endosc Surg.* 2019 Jan;12(1):74-80. doi: 10.1111/ases.12487. Epub 2018 Apr 3. PMID: 29611896.
5. Yadav RP, Adhikary S, Agrawal CS, Bhattarai B, Gupta RK, Ghimire A. A comparative study of early vs. delayed laparoscopic cholecystectomy in acute cholecystitis. *Kathmandu Univ Med J (KUMJ).* 2009 Jan-Mar;7(25):16-20. doi: 10.3126/kumj.v7i1.1759. PMID: 19483447.
6. Mazeh H, Mizrahi I, Dior U, Simanovsky N, Shapiro M, Freund HR, Eid A. Role of antibiotic therapy in mild acute calculus cholecystitis: a prospective randomized controlled trial. *World J Surg.* 2012 Aug;36(8):1750-9. doi: 10.1007/s00268-012-1572-6. PMID: 22456803.
7. Lucidi V, Buggenhout A, Donckier V. Cholecystectomy in cirrhotic patients: pitfalls and reasonable recommendations. *Acta Chir Belg.* 2009 Jul-Aug;109(4):477-80. doi: 10.1080/00015458.2009.11680463. PMID: 19803258.
8. Kim SB, Kim TN, Chung HH, Kim KH. Small Gallstone Size and Delayed Cholecystectomy Increase the Risk of Recurrent Pancreatobiliary Complications After Resolved Acute Biliary Pancreatitis. *Dig Dis Sci.* 2017 Mar;62(3):777-783. doi: 10.1007/s10620-016-4428-3. Epub 2016 Dec 29. PMID: 28035552.
9. Demehri FR, Alam HB. Evidence-Based Management of Common Gallstone-Related Emergencies. *J Intensive Care Med.* 2016 Jan;31(1):3-13. doi: 10.1177/0885066614554192. Epub 2014 Oct 15. PMID: 25320159.
10. Akyürek N, Salman B, Yüksel O, Tezcaner T, Irkörüçü O, Yücel C, Oktar S, Tatlıcioğlu E. Management of acute calculous cholecystitis in high-risk patients: percutaneous cholecystotomy followed by early laparoscopic cholecystectomy. *Surg Laparosc Endosc Percutan Tech.* 2005 Dec;15(6):315-20. doi: 10.1097/01.sle.0000191619.02145.c0. PMID: 16340560.
11. Caglià P, Costa S, Tracia A, Veroux M, Luca S, Zappulla E, Russo V, Lucifora B, Borzì L, Patanè G, Trovato S, Amodeo C. Can laparoscopic cholecystectomy be safely performed in the elderly? *Ann Ital Chir.* 2012 Jan-Feb;83(1):21-4. PMID: 22352211.
12. Tian Y, Suo X. Surgical treatment of acute calculous cholecystitis complicated with hepatic dysfunction. *Medicine (Baltimore).* 2020 Jun 12;99(24):e20239. doi: 10.1097/MD.00000000000020239. PMID: 32541450; PMCID: PMC7302637.
13. de Mestral C, Rotstein OD, Laupacis A, Hoch JS, Zagorski B, Nathens AB. A population-based analysis of the clinical course of 10,304 patients with acute cholecystitis, discharged without cholecystectomy. *J Trauma Acute Care Surg.* 2013 Jan;74(1):26-30; discussion 30-1. doi: 10.1097/TA.0b013e3182788e4d. PMID: 23271073.
14. Sandzén B, Haapamäki MM, Nilsson E, Stenlund HC, Oman M. Surgery for acute gallbladder disease in Sweden 1989-2006--a register study. *Scand J Gastroenterol.* 2013 Apr;48(4):480-6. doi: 10.3109/00365521.2012.763177. Epub 2013 Jan 28. PMID: 23356689.
15. Hasbahçeci M, Alımoğlu O, Başak F, Canbak T, Şışık A, Çalışkan Evren M, Baş G. Review of clinical experience with acute cholecystitis on the development of subsequent gallstone-related complications. *Turk J Med Sci.* 2014;44(5):883-8. doi: 10.3906/sag-1209-2. PMID: 25539562.
16. Anwar HA, Ahmed QA, Bradpiece HA. Removing symptomatic gallstones at their first emergency presentation. *Ann R Coll Surg Engl.* 2008 Jul;90(5):394-7. doi: 10.1308/003588408X301037. PMID: 18634735; PMCID: PMC2645741.
17. Sharma SK, Thapa PB, Maharjan DK, Dhakal A, Baral N. Influence of duration of symptoms over perioperative outcomes during emergency laparoscopic cholecystectomy. *Kathmandu Univ Med J (KUMJ).* 2009 Apr-Jun;7(26):120-4. doi: 10.3126/kumj.v7i2.2703. PMID: 20071843.
18. Imdahl A. Wenn die Gallenblase raus muss. Offen ist out! [Laparoscopic cholecystectomy is the current standard intervention]. *MMW Fortschr Med.* 2005 May 19;147(20):22-5. German. PMID: 15957855.