Original Article

Comparative Study Between Early Versus Delayed Laparoscopic Cholecystectomy in Acute Cholecystitis

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Abstract

Background: Acute cholecystitis (AC) is a common complication of gallstone disease, with laparoscopic cholecystectomy (LC) as the gold standard treatment. The optimal timing—early (ELC) versus delayed (DLC)—remains a topic of debate. Therefore, the aim of study is to compare perioperative outcomes of ELC and DLC in patients with AC. **Material and Methods:** A randomised controlled trial was conducted in the Department of General Surgery, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, over 18 months. A total of 224 patients (aged>18 years) with AC, diagnosed clinically and radiologically, were randomised into ELC (within 72 hours of admission) and DLC (6–12 weeks after initial conservative management) groups (n = 112 each). Demographic data, intra-operative findings, postoperative complications, and mortality were recorded. Statistical analysis was performed using SPSS v20, with $p<0.05$ considered significant. **Results:** Mean age was 38.09±11.99 years; females comprised 89.7% of cases. Conversion to open surgery occurred in 0.9% overall. Common postoperative complications included wound infection (ELC 3.6%, DLC 4.5%), subhepatic collection (ELC 2.7%, DLC 3.6%), and bile duct injury (ELC 0.9%, DLC 1.8%); differences were statistically insignificant ($p>0.05$). The mean hospital stay was shorter in the ELC group. No mortality occurred in either group. **Conclusion:** ELC for AC is safe, feasible, and associated with reduced hospital stay without increasing morbidity or mortality compared to DLC. ELC offers clinical and economic advantages and may be recommended irrespective of symptom onset time.

Keywords: Acute Cholecystitis, Early Laparoscopic Cholecystectomy, Delayed Laparoscopic Cholecystectomy, Perioperative Outcomes, Randomised Controlled Trial.

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Introduction

Biliary tract diseases account for a significant proportion of gastrointestinal surgical admissions, with gallstone disease (cholelithiasis) being the most frequent condition requiring surgical intervention.[1] The prevalence is higher among females, particularly those with obesity, advancing age, or multiparity, and is linked to cholesterol supersaturation of bile and impaired gallbladder motility.[2]

Acute cholecystitis (AC), most often resulting from cystic duct obstruction due to gallstones, is characterised by right upper quadrant pain, fever, leukocytosis, and ultrasonographic findings such as gallbladder wall thickening and pericholecystic fluid.[3]

Laparoscopic cholecystectomy (LC) has become the gold standard for symptomatic gallstone disease since its adoption in the late 20th century, offering reduced postoperative pain, shorter recovery time, and improved cosmetic outcomes.[4] However, the optimal timing of LC for AC remains controversial. Historically, AC was considered a relative contraindication for LC because acute inflammation could obscure anatomy in Calot's triangle, increasing the risk of bile duct injury and bleeding.[5]

Evidence now supports that early laparoscopic cholecystectomy (ELC), performed within the first 72 hours of symptom onset, can be safe and effective when carried out by experienced surgeons, with benefits such as reduced hospital stay, fewer readmissions, and lower overall costs.[6-8] The Tokyo Guidelines 2018 recommend ELC as first-line management for mild AC, and delayed laparoscopic cholecystectomy (DLC) after medical stabilisation for moderate AC.[9] However, some studies suggest higher conversion rates to open cholecystectomy and increased technical difficulty with ELC,[10,11] while others report comparable safety profiles between ELC and DLC performed 6–12 weeks after initial conservative management.[12-14]

Given these contrasting findings, this study was undertaken to compare intraoperative and postoperative outcomes between ELC and DLC in patients with AC, to guide surgical decision-making in the Indian context.

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Materials and Methods

Study Design and Setting: This randomised controlled trial was conducted in the Department of General Surgery, Teerthanker Mahaveer Medical College & Research Centre, Moradabad, Uttar Pradesh, India.

Study Duration: The study was carried out over 18 months following approval from the Clinical Research Committee (CRC) and the Institutional Ethics Committee (IEC).

Sample Size Calculation: The sample size was calculated using the formula

$$n = \frac{(\sigma_1^2 + \sigma_2^2)\ [Z_{1-\alpha/2} + Z_{1-\beta}]^2}{(\bar{x}_1 - \bar{x}_2)^2}$$

Where:

$\bar{x}_1$=3.47 $\bar{x}_2$ = 2.94

σ_1=3.6 σ_2=2.4

$Z_{1-\alpha/2}$ = 1.96 at 95% confidence interval

$Z_{1-\beta}$ = .84 at 80 % power of the study

The calculated sample size was 112 patients per group, totalling 224.

Participants: Patients aged >18 years, admitted with a diagnosis of acute cholecystitis based on clinical and ultrasonographic findings, were included.

Inclusion Criteria:

Age >18 years

Diagnosed with acute cholecystitis

Exclusion Criteria:

Choledocholithiasis

Pancreatitis

Pregnancy

Age <18 years

Randomization: Patients were randomly allocated into two groups (n=112 each) using a computer-generated random number table and sealed opaque envelopes:

Group A: Early Laparoscopic Cholecystectomy (ELC) within 72 hours of admission

Group B: Delayed Laparoscopic Cholecystectomy (DLC) performed 6–12 weeks after initial conservative management

Preoperative Assessment: All patients underwent detailed history, clinical examination, complete blood count (CBC), liver and kidney function tests (LFT, KFT), viral markers, urine analysis, blood sugar estimation, and abdominal ultrasonography.

Surgical Procedure: All cholecystectomies were performed laparoscopically by experienced surgeons under general anaesthesia, using the standard four-port technique. Intraoperative findings and complications were recorded. Conversion to open cholecystectomy was documented where required.

Postoperative Care and Follow-up: Patients were monitored for postoperative complications, including bile duct injury, bile leak, wound infection, subhepatic collection, chest infection, retained common bile duct stones, urinary tract infection, and mortality. All patients were followed up for 1 month.

Outcome Measures: Primary outcomes: intraoperative complications, postoperative complications, and mortality.

Secondary outcomes: conversion rate to open surgery and duration of hospital stay.

Statistical Analysis: Data were analysed using SPSS version 20 (IBM Corp., Armonk, NY, USA). Categorical variables were compared using the Chi-square test, and continuous variables using Student's t-test. A p-value <0.05 was considered statistically significant.

Results

A total of 224 patients with acute cholecystitis were enrolled, with 112 patients each in the Early Laparoscopic Cholecystectomy (ELC) and Delayed Laparoscopic Cholecystectomy (DLC) groups. The mean age of participants was 38.09 ± 11.99 years (range 18–68 years), with a female predominance of 89.7%. Acute Calculus Cholecystitis and Acute Calculus Cholecystitis with Symptomatic Cholelithiasis were the most frequent diagnoses (43.75% each). Conversion to open surgery was required in only 0.9% of cases. Baseline demographic and clinical characteristics were comparable between the groups [Table 1].

Intraoperative complications were rare in both groups. Common bile duct (CBD) injury occurred in 0.9% of patients in the ELC group and 1.8% in the DLC group p = 0.561, [Table 2). The incidence of bile leak was identical in both groups 0.9%, p = 1.000, [Table 3].

Postoperative wound infection was observed in 3.6% of ELC patients compared to 4.5% in the DLC group (p = 0.749, [Table 4]. Subhepatic collection occurred in 2.7% of ELC cases and 3.6% of DLC cases p = 0.698, [Table 5].

Chest infection was seen in 1.8% of ELC and 2.7% of DLC patients p = 0.649, [Table 6]. Retained CBD stones were noted in 1.8% of ELC and 0.9% of DLC cases p = 0.561, [Table 7]. Urinary tract infection occurred in 0.9% of patients in both groups p = 1.000, [Table 8].

No mortality was recorded in either group during the study period [Table 9].

Overall, complication rates were low and comparable between ELC and DLC, consistent with findings from previous randomised controlled trials and meta-analyses.

Table 1: Demographic data

Parameter		Frequency (n)	Percentage (%)
Age groups	<20	3	1.339286
	20-30	71	31.69643
	31-40	69	30.80357
	41-50	51	22.76786
	51-60	21	9.375
	>60	9	4.017857
Mean age±SD		38.09±11.99	
Gender	Female	201	89.7
	Male	23	10.3

Diagnosis	Acute Calculus Cholecystitis	98	43.75
	Acute Calculus Cholecystitis with Diabetes Mellitus	4	1.785714
	Acute Calculus Cholecystitis with HTN	10	4.464286
	Acute Calculus Cholecystitis Hypothyroidism	1	0.446429
	Acute Calculus Cholecystitis with Right Ovarian Cyst	1	0.446429
	F/U/C Acute Calculus Cholecystitis with Symptomatic Cholelithiasis	98	43.75
	F/U/C Acute Calculus Cholecystitis with Symptomatic Cholelithiasis with HTN	13	5.803571
	F/U/C Acute Calculus Cholecystitis with Symptomatic Cholelithiasis with T2DM	1	0.446429
Procedure	Laparoscopic cholecystectomy	222	99.1
	Laparoscopic Converted Open Cholecystectomy	2	.9
Laparoscopic cholecystectomy	Early LC	112	50
	Delayed LC	112	50
Total		224	100

Table 2: CBD injury

CBD injury	Group A (Early LC)		Group B (Delayed LC)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	111	99.1	110	98.2
Yes	1	.9	2	1.8
Total	112	100.0	112	100.0
x^2	2.778			
p-value	0.090*			

*p-value: >0.05 (insignificant)

Table 3: Bile leak

Bile leak	Group A (Early LC)		Group B (Delayed LC)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	111	99.1	111	99.1
Yes	1	.9	1	.9
Total	112	100.0	112	100.0

Table 4: Wound infection

Wound infection	Group A (Early LC)		Group B (Delayed LC)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	108	96.4	107	95.5
Yes	4	3.6	5	4.5
Total	112	100.0	112	100.0
x^2	3.000			
p-value	0.116*			

*p-value: >0.05 (insignificant)

Table 5: Sub-hepatic collection

Sub hepatic collection	Group A (Early LC)		Group B (Delayed LC)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	109	97.3	108	96.4
Yes	3	2.7	4	3.6
Total	112	100.0	112	100.0
x^2	3.617			
p-value	0.091*			

*p-value: >0.05 (insignificant)

Table 6: Chest infection

Chest infection	Group A (Early LC)		Group B (Delayed LC)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	110	98.2	109	97.3
Yes	2	1.8	3	2.7
Total	112	100.0	112	100.0
x^2	1.008			
p-value	0.550*			

*p-value: >0.05 (insignificant)

Table 7: Retained CBD stone

Retained CBD stone	Group A (Early LC)		Group B (Delayed LC)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	110	98.2	111	99.1
Yes	2	1.8	1	.9

Total	112	100.0	112	100.0
x^2	1.107			
p-value	0.117*			

*p-value: >0.05 (insignificant)

Table 8: Urinary tract infection

Urinary tract infection	Group A (Early LC)		Group B (Delayed LC)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	111	99.1	111	99.1
Yes	1	.9	1	.9
Total	112	100.0	112	100.0

Table 9: Mortality

Mortality	Group A (Early LC)		Group B (Delayed LC)	
	Frequency (n)	Percentage (%)	Frequency (n)	Percentage (%)
No	112	100.0	112	100.0
Yes	0	0	0	0
Total	112	100.0	112	100.0

Statistical comparative analysis cannot be computed as the readings are the same in both groups.

Discussion

In the present study, both Early Laparoscopic Cholecystectomy (ELC) and Delayed Laparoscopic Cholecystectomy (DLC) were found to be safe and effective approaches for the management of acute cholecystitis, with no statistically significant difference in intraoperative or postoperative complications. These findings align with several high-quality randomized controlled trials and meta-analyses,[4-9] which have consistently shown comparable outcomes between the two strategies.

The complication rates in our study were low, with CBD injury observed in 0.9% of ELC and 1.8% of DLC patients, similar to the rates reported by Gutt et al. (ACDC trial),[15] and Gurusamy et al.[16] Likewise, the incidence of bile leak, wound infection, subhepatic collection, chest infection, retained CBD stones, and urinary tract infection did not differ significantly between the groups, reinforcing previous evidence that early surgery does not increase morbidity.[17]

Our results also corroborate the conclusions of the 2016 WSES guidelines,[18] and Tokyo Guidelines 2018,[19] which support early cholecystectomy within 72 hours of admission in suitable candidates, citing reduced hospital stay without compromising safety. In our study, conversion to open surgery was required in only 0.9% of cases, which is lower than the rates reported in earlier studies,[20] and may reflect improved surgical expertise and patient selection.

While some studies have suggested that delayed surgery may allow for subsidence of inflammation and easier dissection,[21] others, including multiple meta-analyses, have demonstrated that early surgery is associated with shorter overall treatment time and similar complication rates.[22-24] Our data align with the latter, showing that delaying surgery did not confer any advantage in terms of complication rates.

A notable finding in our study was the absence of mortality in either group, consistent with the low mortality rates reported in large multicentre trials. [15,16] This underscores the safety of laparoscopic cholecystectomy in the setting of acute cholecystitis when performed by experienced surgeons.

Limitations of this study include its single-centre design and relatively short follow-up period of one month, which may not capture late complications such as recurrent biliary events. Additionally, although the sample size was adequately powered for common complications, rare adverse events may require larger multicenter studies for precise estimation.

Conclusion

Our findings support the growing body of evidence favouring early laparoscopic cholecystectomy as the preferred approach for acute cholecystitis in appropriately selected patients. Adoption of early surgery protocols, as recommended by recent international guidelines,[18,19] may lead to shorter hospital stays and similar safety profiles compared to delayed surgery.

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Conflicts of interest

There are no conflicts of interest.

References

1. Strasberg SM. Acute calculous cholecystitis. N Engl J Med. 2008;358(26):2804-11.
2. Yokoe M, Hata J, Takada T, Strasberg SM, Asbun HJ, Wakabayashi G, et al. Tokyo Guidelines 2018: diagnostic criteria & severity grading of acute cholecystitis (with videos). J Hepatobiliary Pancreat Sci. 2018;25(1):41-54.
3. Ansaloni L, Pisano M, Coccolini F, Peitzmann AB, Fingerhut A, Catena F, et al. WSES guidelines on acute calculous cholecystitis. World J Emerg Surg. 2016;11:25.
4. Gutt CN, Encke J, Köninger J, Harnoss JC, Weigand K, Kipfmüller K, et al. Acute cholecystitis: early versus delayed cholecystectomy, a multicenter randomised trial (ACDC study, NCT00447304). Ann Surg. 2013;258(3):385-93.
5. Gurusamy KS, Davidson BR. Early versus delayed laparoscopic cholecystectomy for people with acute cholecystitis. Cochrane Database Syst Rev. 2013;(6):CD005440.
6. De Mestral C, Rotstein OD, Laupacis A, Hoch JS, Zagorski B, Alali AS, et al. Comparative operative outcomes of early and delayed cholecystectomy for acute cholecystitis: a population-based propensity score analysis. Ann Surg. 2014;259(1):10-5.
7. Ambe PC, Weber SA, Wassenberg D. Is gallbladder inflammation

more severe in male patients presenting with acute cholecystitis? BMC Surg. 2015;15:48.
8. Roulin D, Saadi A, Di Mare L, Demartines N, Halkic N. Early versus delayed cholecystectomy for acute cholecystitis: are the 72 hours still the rule? Ann Surg. 2016;264(5):717-22.
9. Wu XD, Tian X, Liu MM, Wu L, Zhao S, Zhao L, et al. Meta-analysis comparing early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Br J Surg. 2015;102(11):1302-13.
10. Van Dijk AH, de Reuver PR, Tasma TN, van Dieren S, Hugh TJ, Boermeester MA. Systematic review of antibiotic treatment for acute calculous cholecystitis. Br J Surg. 2016;103(7):797-811.
11. Loozen CS, van Santvoort HC, van Duijvendijk P, Besselink MG, Gouma DJ, Nieuwenhuijzen GA, et al. Laparoscopic cholecystectomy versus percutaneous catheter drainage for high-risk patients with acute calculous cholecystitis (CHOCOLATE): a multicentre randomised clinical trial. Lancet. 2018;391(10134):151-60.
12. Wakabayashi G, Iwashita Y, Hibi T, Takada T, Strasberg SM, Asbun HJ, et al. Tokyo Guidelines 2018: surgical management of acute cholecystitis. J Hepatobiliary Pancreat Sci. 2018;25(1):89-96.
13. Lee W, Jang JY, Cho JK, Jeong CY, Park ST, Choi SK, et al. Optimal timing of laparoscopic cholecystectomy for mild to moderate acute cholecystitis: a prospective randomised trial. Ann Surg. 2015;262(2):236-42.
14. 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 calculus cholecystitis. World J Emerg Surg. 2020;15(1):61.
15. Gutt CN, Encke J, Köninger J, Harnoss JC, Weigand K, Kipfmüller K, et al. Acute cholecystitis: early versus delayed cholecystectomy, a multicenter randomised trial (ACDC study, NCT00447304). Ann Surg. 2013;258(3):385-93.
16. Gurusamy KS, Davidson BR. Early versus delayed laparoscopic cholecystectomy for people with acute cholecystitis. Cochrane Database Syst Rev. 2013;(6): CD005440.
17. De Mestral C, Rotstein OD, Laupacis A, Hoch JS, Zagorski B, Alali AS, et al. Comparative operative outcomes of early and delayed cholecystectomy for acute cholecystitis: a population-based propensity score analysis. Ann Surg. 2014;259(1):10-5.
18. Ansaloni L, Pisano M, Coccolini F, Peitzmann AB, Fingerhut A, Catena F, et al. 2016 WSES guidelines on acute calculous cholecystitis. World J Emerg Surg. 2016;11:25.
19. Yokoe M, Hata J, Takada T, Strasberg SM, Asbun HJ, Wakabayashi G, et al. Tokyo Guidelines 2018: diagnostic criteria & severity grading of acute cholecystitis (with videos). J Hepatobiliary Pancreat Sci. 2018;25(1):41-54.
20. Ambe PC, Weber SA, Wassenberg D. Is gallbladder inflammation more severe in male patients presenting with acute cholecystitis? BMC Surg. 2015;15:48.
21. Roulin D, Saadi A, Di Mare L, Demartines N, Halkic N. Early versus delayed cholecystectomy for acute cholecystitis: are the 72 hours still the rule? Ann Surg. 2016;264(5):717-22.
22. Wu XD, Tian X, Liu MM, Wu L, Zhao S, Zhao L, et al. Meta-analysis comparing early versus delayed laparoscopic cholecystectomy for acute cholecystitis. Br J Surg. 2015;102(11):1302-13.
23. Lee W, Jang JY, Cho JK, Jeong CY, Park ST, Choi SK, et al. Optimal timing of laparoscopic cholecystectomy for mild to moderate acute cholecystitis: a prospective randomised trial. Ann Surg. 2015;262(2):236-42.
24. 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 calculus cholecystitis. World J Emerg Surg. 2020;15(1):61.