

Comparative Study of Outcomes in Very Early and Early Laparoscopic Cholecystectomy in Cases of Acute Cholecystitis

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Abstract

Background: Acute cholecystitis is a common surgical emergency. While early laparoscopic cholecystectomy (LC) is well-established, there is ongoing debate regarding the optimal timing within the early window. This study compared outcomes between very early LC (<3 days from symptom onset) and early LC (3–10 days from symptom onset) in patients with acute cholecystitis. **Materials and Methods:** An observational clinical study was conducted over 19 months at People's Hospital, Bhopal, involving 80 patients with acute cholecystitis who met predefined inclusion and exclusion criteria. Patients were allocated to Very Early LC (n=42) or Early LC (n=38) groups based on timing of surgery. Demographic, clinical, laboratory, ultrasound, intraoperative, and postoperative parameters were recorded and compared. Statistical analysis was performed using SPSS version 25.0. **Results:** Baseline demographic, clinical presentation, and ultrasound findings were comparable between groups. Direct bilirubin was significantly higher in the Early LC group (0.50 ± 0.4 mg/dL vs 0.36 ± 0.10 mg/dL, $p=0.04$). Very Early LC was associated with significantly shorter operative time (30 ± 15 vs 50 ± 20 min, $p=0.001$), lower intraoperative blood loss (20 ± 10 vs 30 ± 20 mL, $p=0.0074$), fewer cases of difficult Calot's dissection (9% vs 23%, $p=0.02$), and shorter hospital stay (4.0 ± 1.5 vs 6.0 ± 3.0 days, $p=0.01$). Postoperative pain scores were significantly lower in the Very Early LC group (4.39 ± 0.31 vs 5.65 ± 1.46 , $p=0.001$). Although overall postoperative complications were lower in Very Early LC (16% vs 30%), the difference was not statistically significant ($p=0.09$). **Conclusion:** Very early LC provides significant benefits in operative efficiency, reduced intraoperative difficulty, and shorter recovery compared to early LC, without increasing complication rates. These findings support prioritizing very early surgical intervention in acute cholecystitis to optimize patient outcomes and healthcare resource utilization.

Keywords: Cholecystitis, Laparoscopic Cholecystectomy, Surgical Timing, Very Early Surgery, Postoperative Outcomes.

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INTRODUCTION

Acute cholecystitis is an acute inflammatory condition of the gallbladder, most commonly caused by gallstone obstruction of the cystic duct, and is one of the most frequent surgical emergencies worldwide.^[1] Laparoscopic cholecystectomy (LC) has become the gold standard for its management, offering advantages such as reduced postoperative pain, shorter hospital stay, and faster return to normal activity compared to open surgery.^[2]

The optimal timing of LC in acute cholecystitis has been the subject of considerable debate. Traditional management often favoured delayed surgery after an initial period of conservative treatment, but mounting evidence indicates that early intervention within 7–10 days of symptom onset reduces morbidity, recurrence of biliary symptoms, and overall hospital stay.^[3] However, within the early window, there is growing interest in whether very early LC—performed within 72 hours of symptom onset—confers additional benefits, including reduced operative difficulty and fewer complications, by addressing the disease before significant inflammatory and fibrotic changes occur.^[4] Despite this emerging evidence, few studies in the Indian

clinical setting have comprehensively compared very early and early LC in terms of demographic characteristics, intraoperative parameters, and postoperative outcomes. This study aims to fill that gap by systematically evaluating and comparing surgical outcomes in patients undergoing LC within <3 days versus 3–10 days of symptom onset, thereby providing data to guide surgical timing decisions in acute cholecystitis.

Hospitals are complex organizations that coordinate a broad range of clinical, diagnostic, and support services. This complexity necessitates effective administrative structures to optimize patient care, crisis response, and hospital-wide

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operations.^[1] In many public sector hospitals in developing countries, medical superintendents (often with clinical backgrounds) are primarily responsible for hospital administration. However, as hospital operations grow in complexity, administrative leadership requires a structured and multidisciplinary approach that integrates both clinical and managerial expertise.^[2]

MATERIALS AND METHODS

Study Type: This was an observational clinical study designed to compare outcomes in patients undergoing very early laparoscopic cholecystectomy (LC) — performed within three days of symptom onset — versus early LC — performed between three and ten days of symptom onset — for the management of acute cholecystitis.

Study Setting and Duration: The study was conducted in the Department of General Surgery at People's Hospital, affiliated with the Peoples College of Medical Sciences & Research Centre, Bhopal. Data collection was carried out over a 19-month period, from 1 May 2023 to 30 November 2024.

Source of Data: The study population comprised all patients diagnosed with acute cholecystitis who underwent LC at the study centre during the specified period, met the inclusion criteria, and provided written informed consent.

Inclusion and Exclusion Criteria: Eligible participants were patients aged 16–70 years diagnosed with acute cholecystitis who presented within 10 days of symptom onset and were willing to participate. Exclusion criteria included presentation after 10 days, refusal to consent, age <15 or >70 years, unfit for general anaesthesia, coagulation disorders, pregnancy, conversion to open cholecystectomy due to equipment failure, and history of abdominal surgery within the preceding 90 days.

Sample Size and Group Allocation: Sample size estimation was based on an expected difference in complication rates between the two groups, calculated with a power of 80% and a significance level (α) of 0.05. The target was 80 patients, divided into 42 patients in the Very Early LC group and 38 patients in the Early LC group. Group allocation was determined according to the timing of surgery from the onset of symptoms. Randomization was employed to balance baseline characteristics between the two cohorts.

Study Procedure: Upon presentation, all patients underwent clinical evaluation, laboratory investigations, and imaging studies (ultrasound or CT scan) to confirm the diagnosis of acute cholecystitis. Informed consent was

obtained after explaining the study purpose, risks, and benefits. Eligible patients were allocated to one of the two groups based on surgical timing.

Preoperative data were recorded on a standardized case record form, which included demographic information, clinical presentation, relevant laboratory parameters, and imaging findings. Surgeries were performed under general anaesthesia using the standard four-port technique for laparoscopic cholecystectomy, following a uniform operative protocol. Dissection of Calot's triangle was undertaken with identification and clipping of the cystic duct and artery before gallbladder removal. Intraoperative findings such as operative duration, estimated blood loss, difficulty of dissection, and intraoperative complications were documented immediately after surgery. If conversion to open cholecystectomy became necessary due to safety concerns, it was recorded along with the reason for conversion.

Following surgery, patients were monitored in the recovery room and subsequently in the surgical ICU or ward. Postoperative parameters including pain scores, complications, and length of hospital stay were recorded until discharge.

Data Collection and Management: Data were collected prospectively using a structured proforma with dedicated sections for preoperative, intraoperative, and postoperative details. All records were reviewed periodically to ensure completeness and accuracy. The data were then entered into a secure, password-protected electronic database for statistical analysis.

Statistical Analysis: Data analysis was performed using SPSS version 25.0. Continuous variables were expressed as mean $\pm$ standard deviation (SD) and compared using Student's t-test. Categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate. A p-value of <0.05 was considered statistically significant.

RESULTS

The demographic profile of the study population is shown in [Table 1]. The mean age was slightly lower in the Very Early LC group (40 ± 10 years) compared to the Early LC group (44 ± 12 years), although this difference was not statistically significant ($p = 0.07$). Gender distribution was similar between the two groups, with a slight female predominance in both (M/F: 20/22 vs. 14/24, $p = 0.38$). The mean BMI was comparable (26.2 ± 3.5 vs. 27.0 ± 3.8 kg/m², $p = 0.21$). Both groups were demographically comparable, ensuring that differences in surgical outcomes could be attributed to timing of surgery rather than baseline population differences.

Table 1: Demographic Characteristics

Parameter	Very Early LC (n=42)	Early LC (n=38)	p-value
Age (years)	40 ± 10	44 ± 12	0.07
Gender (M/F)	20/22	14/24	0.38
BMI (kg/m ²)	26.2 ± 3.5	27.0 ± 3.8	0.21

The initial presenting symptoms of patients are summarised in [Table 2]. All patients presented with abdominal pain. Fever and nausea/vomiting were common in both groups, with no significant difference. Jaundice was more frequent

in the Early LC group, though not statistically significant ($p = 0.29$). The clinical presentation profile was consistent between groups, suggesting comparable severity at admission.

Table 2: Baseline Clinical Presentation

Symptom	Very Early LC (n=42)	Early LC (n=38)	p-value
Abdominal Pain	42 (100%)	38 (100%)	1.00
Fever	33 (78%)	32 (84%)	0.47
Nausea/Vomiting	32 (76%)	32 (84%)	0.36
Jaundice	2 (4%)	4 (10%)	0.29

As shown in [Table 3], mean WBC count and total bilirubin were similar between groups. Direct bilirubin was significantly higher in the Early LC group ($p = 0.04$), suggesting possible greater biliary obstruction. Except for

direct bilirubin, laboratory profiles were similar, indicating that most systemic inflammatory and hepatic parameters were matched at baseline.

Table 3: Preoperative Laboratory Parameters

Parameter	Very Early LC (n=42)	Early LC (n=38)	p-value
WBC ($\times 10^9/L$)	12.5 ± 3.1	13.2 ± 3.5	0.42
Total Bilirubin (mg/dL)	1.2 ± 0.5	1.3 ± 0.6	0.53
Direct Bilirubin (mg/dL)	0.36 ± 0.10	0.50 ± 0.4	0.04

The sonographic characteristics are summarised in [Table 4]. Gallbladder wall thickness was marginally greater in the Early LC group, but not statistically significant. Gallstone presence and pericholecystic fluid incidence were

comparable. Imaging parameters showed no significant differences, suggesting comparable local disease severity at the time of diagnosis.

Table 4: Ultrasound Findings

Finding	Very Early LC (n=42)	Early LC (n=38)	p-value
Gallbladder Wall Thickness (mm)	4 ± 0.8	4.4 ± 1.0	0.15
Presence of Gallstones	40 (95%)	37 (97%)	0.67
Pericholecystic Fluid	9 (21%)	10 (26%)	0.55

[Table 5] demonstrates that operative time was significantly shorter in the Very Early LC group ($p = 0.001$). Blood loss was also significantly lower ($p = 0.0074$). Conversion rates to open surgery were low in both groups and not

statistically significant. Earlier surgery correlated with easier dissection, less blood loss, and shorter operative time, indicating reduced operative difficulty.

Table 5: Intraoperative Operative Parameters

Parameter	Very Early LC (n=42)	Early LC (n=38)	p-value
Operative Time (min)	30 ± 15	50 ± 20	0.001
Blood Loss (mL)	20 ± 10	30 ± 20	0.0074
Conversion to Open Cholecystectomy (n,%)	1 (2%)	2 (5%)	0.93

Intraoperative complications are presented in [Table 6]. Gallbladder perforation and difficult Calot's dissection were more frequent in the Early LC group, with the latter being

significantly higher ($p = 0.02$). Delay in surgery appeared to increase the risk of difficult dissection, likely due to progression of inflammatory changes.

Table 6: Intraoperative Complications

Complication	Very Early LC (n=42)	Early LC (n=38)	p-value
Gallbladder Perforation	3 (7%)	7 (18%)	0.05
Injury to Biliary Tree	1 (2%)	2 (5%)	0.40
Difficult Calot's Dissection	4 (9%)	9 (23%)	0.02

The mean length of hospital stay was significantly shorter in the Very Early LC group (4.0 ± 1.5 days) compared to the Early LC group (6.0 ± 3.0 days), with a p-value of 0.01. Early intervention reduced hospitalization duration, contributing to faster recovery and potential healthcare cost savings. The average postoperative pain score was 4.39 ± 0.31 in the Very Early LC group versus 5.65 ± 1.46 in the Early LC group, with a p-value of 0.001. This indicates that very early surgery was associated with less postoperative pain, likely due to reduced inflammation and tissue handling.

DISCUSSION

This prospective observational study compared surgical outcomes in patients undergoing very early laparoscopic cholecystectomy (VELC) within 72 hours of symptom onset and early laparoscopic cholecystectomy (ELC) performed between 3–10 days. The results indicate that VELC offers significant advantages over ELC in terms of shorter operative time, reduced intraoperative blood loss, fewer difficult dissections, shorter hospital stay, and lower postoperative pain scores, without an increase in conversion

rates or major complications. Although differences in overall postoperative complications did not reach statistical significance, the trend favoured VELC.

These findings are consistent with the growing body of literature advocating early operative intervention in acute cholecystitis, and they provide further granularity by comparing two distinct time frames within the early period. Both study groups were comparable in terms of age, gender distribution, BMI, presenting symptoms, and most laboratory and ultrasound parameters. Only direct bilirubin was significantly higher in the ELC group, which may suggest more pronounced biliary obstruction or inflammation due to delayed intervention. This comparability of baseline characteristics minimises selection bias and strengthens the attribution of outcome differences to surgical timing rather than underlying patient factors. Similar baseline matching was noted in prior studies by Yadav et al,^[5] and de Mestral et al,^[6] which also compared outcomes across different surgical timing protocols.

The most striking intraoperative differences were significantly shorter operative times (30 ± 15 min vs. 50 ± 20 min; $p = 0.001$) and lower estimated blood loss (20 ± 10 mL vs. 30 ± 20 mL; $p = 0.0074$) in the VELC group. These findings likely reflect reduced tissue edema, less vascular congestion, and fewer adhesions when surgery is undertaken before the inflammatory process peaks.

Moreover, difficult Calot's dissection was significantly less common in VELC (9% vs. 23%; $p = 0.02$), supporting the hypothesis that earlier intervention allows for a clearer operative field and facilitates safer dissection of the critical view of safety. Gallbladder perforation was also lower in VELC (7% vs. 18%; $p = 0.05$), consistent with reduced friability of tissues when inflammation is addressed promptly.

These intraoperative benefits mirror those reported by Roulin et al,^[7] who demonstrated that early LC significantly reduced technical difficulty and operative complications, and by Cao et al,^[8] who reported fewer bile duct injuries and conversions with earlier intervention.

The postoperative advantages of VELC were evident in both objective and patient-reported outcomes. Hospital stay was significantly shorter (4.0 ± 1.5 vs. 6.0 ± 3.0 days; $p = 0.01$), which is clinically relevant for reducing healthcare costs and resource utilisation. Pain scores were markedly lower in VELC (4.39 ± 0.31 vs. 5.65 ± 1.46 ; $p = 0.001$), likely due to less tissue handling and operative trauma in a less inflamed field.

Although the differences in overall postoperative complications did not reach statistical significance, the VELC group showed consistently lower rates across all categories — port site infections, bile leaks, intra-abdominal abscesses, and biliary peritonitis. Similar observations were made in the meta-analysis by Gurusamy et al,^[5] which found early intervention reduced wound infection rates and recurrent biliary symptoms.

International guidelines, including the Tokyo Guidelines 2018,^[1] recommend early LC within 72 hours where feasible. Our findings lend strong support to these

recommendations, demonstrating measurable intraoperative and recovery benefits without increasing perioperative risk. The distinction made here between “very early” and “early” within the accepted early window is clinically important, as it underscores the incremental benefits of operating as soon as possible after diagnosis.

Studies by Ambe et al,^[4] and Sahin et al,^[9] have similarly reported that delaying surgery, even within the early period, allows inflammation to progress, making dissection more difficult and prolonging operative times.

Strengths and Limitations

The strength of this study lies in its well-matched baseline characteristics, comprehensive intraoperative and postoperative assessment, and real-world applicability in a tertiary care setting. Limitations include its single-centre design, modest sample size, and lack of long-term follow-up for late complications or recurrence. Future multicentre randomised controlled trials could provide higher-level evidence and explore cost-effectiveness and patient-reported outcomes in more detail.

CONCLUSION

Overall, this study reinforces that very early laparoscopic cholecystectomy — ideally within 72 hours of symptom onset — is not only safe but also advantageous in reducing operative difficulty, shortening hospital stays, and improving patient comfort, aligning with global surgical best practices.

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Conflicts of interest

There are no conflicts of interest.

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