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Research Article

Comparing Outcomes of Early Laparoscopic Cholecystectomy versus Delayed Surgery for Patients with Acute Cholecystitis

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Abstract

Background: Acute cholecystitis (AC) is a common surgical emergency. The optimal timing for laparoscopic cholecystectomy (LC) remains a topic of debate, balancing the risks of operating on an inflamed tissue against the complications of delayed management. This study aimed to compare the outcomes of early laparoscopic cholecystectomy (ELC) versus delayed laparoscopic cholecystectomy (DLC) in patients with AC.

Methods: A prospective, randomized study was conducted for 1-year. Forty-eight patients diagnosed with AC were randomly allocated into two groups: the ELC group (surgery within 24 hours of diagnosis, n=24) and the DLC group (initial conservative management with antibiotics followed by elective LC 6-8 weeks later, n=24). Primary outcomes were total hospital stay, operative time, and conversion rate to open cholecystectomy. Secondary outcomes included intra-operative and post-operative complications.

Results: The two groups were comparable in terms of age, gender, and comorbidities. The mean total hospital stay was significantly shorter in the ELC group (3.2 ± 1.1 days) compared to the

DLC group (8.5 ± 2.3 days, $p < 0.001$). The mean operative time was longer in the ELC group (95.4 ± 22.1 min) than in the DLC group (78.3 ± 18.5 min, $p = 0.006$). The conversion rate to open surgery was higher in the DLC group (16.7%, 4/24) than in the ELC group (8.3%, 2/24), but this difference was not statistically significant ($p = 0.665$). Complication rates were similar between groups, with no mortality in either arm.

Conclusion: For patients with acute cholecystitis, ELC within 24 hours of diagnosis is superior to the delayed approach, as it significantly reduces the total hospital stay without a significant increase in major complications or conversion rates, despite a longer operative time. ELC should be considered the standard of care for managing this condition.

Keywords: Acute Cholecystitis, Laparoscopic Cholecystectomy, Early Surgery, Delayed Surgery, Randomized Controlled Trial, Surgical Outcomes.

Introduction

Acute cholecystitis (AC), an inflammation of the gallbladder most commonly due to gallstone obstruction of the cystic duct, represents a significant portion of emergency surgical admissions worldwide [1]. The introduction of laparoscopic cholecystectomy (LC) revolutionized the management of gallstone disease, offering reduced post-operative pain, shorter recovery, and improved cosmesis compared to open surgery [2].

Historically, the standard management for AC was initial conservative treatment with antibiotics and analgesia, followed by an interval cholecystectomy 6 to 8 weeks later, a strategy known as delayed laparoscopic cholecystectomy (DLC). This approach was adopted to allow the resolution of acute inflammation, theoretically making the surgery technically easier and safer [3]. However,

this strategy carries the risks of recurrent biliary events while awaiting surgery, repeated hospital admissions, and a prolonged total illness duration.

In contrast, early laparoscopic cholecystectomy (ELC), performed within 24 to 72 hours of symptom onset or diagnosis, aims to resolve the disease definitively in a single hospital admission. Several meta-analyses and large cohort studies have suggested that ELC is safe and reduces the total hospital stay [4, 5]. Despite this evidence, the adoption of ELC varies, with concerns about higher conversion rates and bile duct injuries in the setting of acute inflammation persisting in some surgical communities [6].

The primary objective of this prospective, randomized study was to compare the outcomes of ELC and DLC in a controlled cohort of 48 patients with AC, focusing on total hospital stay, operative time, and conversion rates.

Methods

Study Design and Patient Selection

This was a prospective, randomized controlled trial conducted at a tertiary care teaching hospital over a 12-month period. The study protocol was approved by the Institutional Ethics Committee, and written informed consent was obtained from all participants.

Inclusion criteria

Patients aged 18-70 years presenting to the emergency department with a diagnosis of acute cholecystitis, as defined by the Tokyo Guidelines 2010 [7] (local signs of inflammation, systemic signs of inflammation, and confirmatory imaging findings on ultrasonography), were considered for enrollment.

Exclusion criteria

(1) duration of symptoms >96 hours, (2) evidence of gangrenous or perforated cholecystitis on imaging, (3) severe cardiopulmonary comorbidities precluding general anesthesia, (4) pregnancy, (5) previous upper abdominal surgery, and (6) suspicion of common bile duct stones or pancreatitis.

Randomization and Intervention

A total of 48 eligible patients were enrolled and randomly allocated into one of two treatment groups using computer-generated random numbers sealed in opaque envelopes.

- **ELC Group (n=24):** Patients underwent laparoscopic cholecystectomy within 24 hours of randomization and diagnosis.
- **DLC Group (n=24):** Patients were initially managed conservatively with intravenous antibiotics (Ceftriaxone and Metronidazole), nil per os, and intravenous fluids. After resolution of the acute episode, they were discharged and scheduled for an elective laparoscopic cholecystectomy 6-8 weeks later.

All surgical procedures were performed by one of two consultant surgeons with over 10 years of experience in laparoscopic surgery, using a standard four-port technique.

Outcome Measures

The primary outcome measures were:

1. **Total Hospital Stay:** Calculated from admission to final discharge (for ELC, a single stay; for DLC, the sum of the initial admission and the readmission for surgery).

2. **Operative Time:** Measured from the first skin incision to the application of the final dressing.

3. **Conversion Rate:** Defined as the need to convert from a laparoscopic to an open procedure.

Secondary outcome measures included:

- Intra-operative complications (e.g., gallbladder perforation, bleeding, bile spillage).
- Post-operative complications (e.g., surgical site infection, bile leak, retained stones, re-admission within 30 days), graded using the Clavien-Dindo classification [8].
- Failure of conservative management in the DLC group, requiring an unplanned early intervention.

Statistical Analysis

Data were analyzed using SPSS Statistics version 28.0. Continuous variables were presented as mean ± standard deviation and compared using the Student's t-test. Categorical variables were presented as numbers and percentages and compared using the Chi-square test or Fisher's exact test, as appropriate. A p-value of < 0.05 was considered statistically significant.

Table 1: Baseline Characteristics of the Study Groups

Characteristic	ELC Group (n=24)	DLC Group (n=24)	p-value
Age (years), mean ± SD	48.5 ± 11.2	51.3 ± 12.8	0.412
Gender (Male/Female)	10 / 14	12 / 12	0.571
BMI (kg/m²), mean ± SD	28.4 ± 3.8	29.1 ± 4.2	0.543

Characteristic	ELC Group (n=24)	DLC Group (n=24)	p-value
Diabetes Mellitus, n (%)	5 (20.8%)	7 (29.2%)	0.519
Hypertension, n (%)	9 (37.5%)	11 (45.8%)	0.567

The mean age in the Early Laparoscopic Cholecystectomy (ELC) group was 48.5 years (±11.2 SD), compared to 51.3 years (±12.8 SD) in the Delayed Laparoscopic Cholecystectomy (DLC) group, a difference that was not statistically significant ($p = 0.412$). The groups were also well-matched in terms of gender distribution (ELC: 10M/14F vs. DLC: 12M/12F; $p = 0.571$), Body Mass Index (BMI), and the prevalence of comorbidities such as diabetes mellitus and hypertension ($p > 0.05$ for all).

Table 2: Comparison of Primary Outcomes

Outcome Measure	ELC Group (n=24)	DLC Group (n=24)	p-value
Total Hospital Stay (days), mean ± SD	3.2 ± 1.1	8.5 ± 2.3	**<0.001**
Operative Time (min), mean ± SD	95.4 ± 22.1	78.3 ± 18.5	**0.006**
Conversion to Open Surgery, n (%)	2 (8.3%)	4 (16.7%)	0.665

Table 2, revealed significant differences between the two surgical strategies. The most notable finding was the total hospital stay, which was significantly shorter for patients in the ELC group (mean 3.2 ± 1.1 days) compared to those in the DLC group (mean 8.5 ± 2.3 days), with a p-value of < 0.001. Conversely, the mean operative time was significantly longer in the ELC group, at 95.4

± 22.1 minutes, versus 78.3 ± 18.5 minutes in the DLC group (p = 0.006). Regarding the conversion rate to open surgery, two patients (8.3%) in the ELC group required conversion due to severe inflammation and obscured anatomy, while four patients (16.7%) in the DLC group were converted, primarily due to dense fibrotic adhesions. This difference, however, was not statistically significant (p = 0.665).

Table 3: Comparison of Secondary Outcomes (Complications)

Complication Type	ELC Group (n=24)	DLC Group (n=24)	p-value
Intra-operative			
Gallbladder Perforation	6 (25.0%)	3 (12.5%)	0.461
Significant Bleeding (>100ml)	1 (4.2%)	0 (0%)	1.000
Post-operative			
Surgical Site Infection	1 (4.2%)	0 (0%)	1.000
Bile Leak	1 (4.2%)	0 (0%)	1.000
Other Medical Complication	0 (0%)	1 (4.2%)	1.000
Re-admission (Pre-op in DLC)	0 (0%)	1 (4.2%)	1.000

Complication Type	ELC Group (n=24)	DLC Group (n=24)	p-value
Total Patients with ≥1 Complication, n (%)	2 (8.3%)	2 (8.3%)	1.000

The rates of intra-operative complications, such as gallbladder perforation (ELC 25.0% vs. DLC 12.5%; p = 0.461) and significant bleeding, were not significantly different between the groups. Similarly, post-operative complication rates, including surgical site infection and bile leak, were low and comparable. One patient in the DLC group was readmitted with recurrent cholecystitis before their scheduled surgery, requiring percutaneous cholecystostomy. Another patient in the DLC group developed a post-operative urinary tract infection. Overall, the total number of patients who experienced one or more complications was identical in both groups (2 patients, 8.3% in each group; p = 1.000). There were no instances of bile duct injury or mortality in either treatment arm.

Discussion

The findings of this prospective randomized study contribute to the growing consensus on the management of acute cholecystitis, strongly supporting the superiority of the early intervention strategy. Our data demonstrate that ELC performed within 24 hours of diagnosis offers a significant advantage in reducing healthcare utilization, as evidenced by a drastically shorter total hospital stay, without incurring a higher rate of major complications, despite the technical challenges posed by the acutely inflamed gallbladder.

The most compelling benefit of ELC in our cohort was the reduction in the total hospital stay by more than five days. This finding is not only statistically significant but also carries profound implications for patient well-being and healthcare economics. A shorter hospitalization minimizes the risk of hospital-acquired infections, improves patient satisfaction, and reduces overall treatment costs. This advantage is consistently echoed in the literature. For instance, the seminal **ACDC study (Gutt et al., 2003)**, a large multicenter randomized trial, found that ELC significantly reduced the rate of hospital readmissions and the total number of days spent in the hospital within 75 days after randomization. Our results, in a smaller but controlled setting, affirm this key benefit, solidifying ELC as a more efficient patient pathway.

A predictable finding from our study was the significantly longer operative time in the ELC group. This is an intuitive consequence of dissecting inflamed, edematous, and often friable tissues in Calot's triangle, which demands meticulous care to ensure safe critical view of the anatomy. However, this increased operative time did not translate into a higher conversion rate to open surgery. Interestingly, the conversion rate was numerically higher in the DLC group (16.7% vs. 8.3%). This suggests that the subacute inflammatory phase and the subsequent fibrotic reaction that develops during the weeks of waiting for delayed surgery can, in some cases, create a surgically more challenging environment due to dense, vascular adhesions. This phenomenon has been observed in other studies. A meta-analysis by **Wu et al. (2005)** concluded that while ELC was associated with a longer operation, it did not lead to a higher conversion rate compared to DLC, a finding that our results directly support. The fibrotic "freeze" of the delayed phase can sometimes be a greater obstacle than the edematous "dissectable" plane of the early inflammatory phase.

Furthermore, our study adds to the body of evidence confirming the safety of the early approach. The overall complication rates were low and identical between the two groups. The single case of recurrent cholecystitis in the DLC group, which required an unplanned percutaneous cholecystostomy, underscores a critical weakness of the delayed strategy: the inherent risk of treatment failure during the waiting period. This aligns with findings from earlier studies like **Lau et al. (2006)**, whose meta-analysis reported that a significant proportion of patients managed conservatively initially (up to 20%) required emergency admission and intervention before their scheduled surgery. ELC eliminates this uncertainty by providing definitive treatment during the initial admission.

Conclusion

In conclusion, this study demonstrates that for patients with acute cholecystitis, early laparoscopic cholecystectomy within 24 hours of diagnosis is a superior strategy to the delayed approach. ELC provides the definitive benefit of a significantly reduced hospital stay and eliminates the risk of recurrent biliary events, without a significant increase in conversion rates or major morbidity, despite a longer operative time. When performed by experienced surgeons, ELC should be considered the standard of care for managing this common surgical condition.

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