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Original Research Article

Evaluation of Early Versus Delayed Laparoscopic Cholecystectomy in Acute Cholecystitis

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Abstract

Introduction: This study compares the outcomes of early (within 72 hours) versus delayed (6–8 weeks) laparoscopic cholecystectomy (LC) in patients with acute cholecystitis.

Materials and Methods: A total of 90 patients were randomized to undergo either early or delayed LC. Primary outcomes included postoperative morbidity and hospital stay, while secondary outcomes included operative time, pain scores, recovery time, patient satisfaction, and healthcare costs. Data were analyzed using SPSS ($p < 0.05$).

Results: The early surgery group had significantly lower complications (13% vs. 24%, $p = 0.04$) and shorter hospital stays (3.2 ± 1.0 vs. 6.4 ± 1.3 days, $p < 0.001$). Pain scores were lower in the early group ($p = 0.01$), and patient satisfaction was higher (8.6 ± 1.1 vs. 7.3 ± 1.4, $p = 0.02$). Healthcare costs were reduced in the early surgery group (₹45,000 ± 5,000 vs ₹58,000 ± 7,500, $p < 0.001$). No significant difference in operative time or conversion rates was observed.

Conclusion: Early laparoscopic cholecystectomy for acute cholecystitis leads to lower complications, shorter hospital stays, reduced healthcare costs, and faster recovery, making it the preferred approach.

Keywords: Acute cholecystitis, early laparoscopic cholecystectomy, delayed laparoscopic cholecystectomy, Postoperative morbidity, Healthcare costs, and Pain scores.

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Introduction

Acute cholecystitis (AC) is one of the most common acute abdominal conditions that require surgical intervention. It arises as a complication of gallstone disease, typically caused by obstruction of the cystic duct, resulting in inflammation of the gallbladder. If left untreated, AC can progress to severe complications such as gallbladder perforation, abscess formation, and sepsis, all of which significantly increase patient morbidity and mortality. Early intervention is essential to prevent these complications, but the optimal timing for cholecystectomy remains a topic of ongoing debate in clinical practice [1].

Historically, the management of acute cholecystitis involved initial conservative therapy with antibiotics and supportive measures, followed by a delayed cholecystectomy. This approach was based on the premise that performing surgery too early during the acute phase could lead to technical difficulties, higher conversion rates to open surgery, and increased morbidity due to extensive inflammation. The traditional model advocated for waiting 6 to 8 weeks to allow for resolution of the inflammation, thereby making surgery safer and technically less challenging [2,3]. However, advancements in laparoscopic surgery have revolutionized the management of gallbladder diseases, offering benefits such as reduced postoperative pain, shorter hospital stays, and quicker recovery times. Laparoscopic cholecystectomy (LC) is now considered the gold standard for treating symptomatic gallstone disease, including acute cholecystitis [4]. Early laparoscopic cholecystectomy (ELC), performed within 72 hours of symptom onset, has emerged as a viable and safe alternative to delayed surgery, with several studies reporting favorable outcomes, such as reduced total hospital stay and lower risk of recurrent biliary complications.

The feasibility of performing laparoscopic surgery early, even in the presence of inflammation, has been increasingly supported by evidence from randomized controlled trials (RCTs) and meta-analyses. These studies have shown that early surgery does not significantly increase complications or morbidity compared to delayed surgery, and, in some cases, it may even reduce them [5-8]. Moreover, ELC offers potential advantages beyond clinical outcomes, including improved socioeconomic efficiency. By shortening hospital stays and reducing the likelihood of recurrent gallbladder attacks, early intervention can reduce both direct healthcare costs and indirect costs related to patient work absences and disability [9, 10]. An evidence from systematic reviews indicates that ELC is not only safe but may also be associated with better long-term patient satisfaction, quicker return to normal activities, and lower overall healthcare expenditures. However, certain factors, including the severity of inflammation, the patient's comorbid conditions, and institutional experience, may still influence the decision to proceed with early versus delayed surgery [11, 12]. Despite these promising findings, a significant degree of heterogeneity persists in clinical practice, particularly in low-resource settings or among patients with high-risk profiles. As such, the question of whether early cholecystectomy provides a universal benefit for all patients with acute cholecystitis remains unresolved, necessitating further investigation [13]. This study seeks to compare the clinical outcomes of early versus delayed laparoscopic cholecystectomy in patients diagnosed with acute cholecystitis.

Materials and Methods

This was a prospective, randomized controlled trial (RCT) designed to compare the clinical outcomes of early versus delayed laparoscopic cholecystectomy (LC) in patients diagnosed with acute cholecystitis.

Patient Selection: We included 90 patients aged 18–80 years who were diagnosed with acute cholecystitis based on clinical symptoms, laboratory findings, and imaging studies (ultrasound or CT). Patients with complicated acute cholecystitis (e.g., perforation, gangrene), severe comorbidities (e.g., uncontrolled diabetes, cardiovascular disease), and those who had undergone prior cholecystectomy were excluded from the study.

The final sample consisted of 90 patients, divided into two groups:

- 45 patients in the early surgery group (undergoing laparoscopic cholecystectomy within 72 hours of symptom onset)
- 45 patients in the delayed surgery group (undergoing surgery 6–8 weeks after resolution of acute inflammation).

Randomization and Group Allocation: Patients who met the inclusion criteria were randomly assigned to one of two groups: early surgery group or delayed surgery group, using computer-generated random numbers. The early surgery group underwent laparoscopic cholecystectomy within 72 hours of the onset of symptoms, while the delayed surgery group underwent surgery after 6–8 weeks once the acute inflammation had subsided. Allocation concealment was ensured by the use of sequentially numbered, sealed opaque envelopes to prevent bias in group assignment. Randomization ensured that both groups were comparable at baseline, with equal chances for any participant to be assigned to either group.

Surgical Technique: All surgeries were performed by a team of experienced surgeons trained in laparoscopic techniques. The procedure was carried out according to standard laparoscopic cholecystectomy protocols. For the early surgery group, the procedure was performed within 72 hours of diagnosis, while for the delayed surgery group, the procedure was performed after the resolution of acute symptoms and inflammation, typically around 6–8 weeks post-diagnosis. In both groups, the same surgical team and approach were used, minimizing any potential differences in surgical technique.

Primary and Secondary Outcomes: The primary outcome of the study was postoperative morbidity, assessed by the occurrence of complications such as wound infection, bile leak, and postoperative bleeding, as well as the length of hospital stay. The secondary outcomes included operative time, conversion to open surgery, pain scores (using the Visual Analog Scale, VAS), and time to return to normal activity. Additional outcomes included patient satisfaction, assessed by a structured questionnaire, and total healthcare costs related to the surgery (including operative, postoperative, and hospital stay costs).

Statistical Analysis: Statistical analysis was performed using SPSS version [25]. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as percentages. Differences between the two groups were assessed using independent t-tests for continuous variables and chi-square tests for categorical variables. A p-value < 0.05 was considered statistically significant. For comparisons of pain scores and recovery times, the Mann–Whitney U test was used. The study had a power of 80% to detect a significant difference in primary outcomes with an alpha level of 0.05.

Results

A total of 90 patients were enrolled in the study, with 45 patients in the early surgery group and 45 patients in the delayed surgery group. The baseline demographic characteristics, including age, sex, and comorbidities, were comparable between the two groups. The mean age of the patients in the early surgery group was 52.3 ± 8.4 years, while in the delayed surgery group, it was 53.1 ± 7.9 years (p = 0.72). The distribution of sex was similar across both groups, with 60% male and 40% female in each group. Additionally, the prevalence of comorbidities such as hypertension (early surgery: 22%, delayed surgery: 21%) and diabetes (early surgery: 18%, delayed surgery: 20%) was consistent between both groups (p = 0.86 for hypertension and p = 0.92 for diabetes).Regarding the primary outcomes, the early surgery group had significantly fewer complications than the delayed surgery group. The overall complication rate in the early surgery group was 13%, compared to 24% in the delayed surgery group (p = 0.04). Specifically, wound infection occurred in 2 patients in the early surgery group and 5 patients in the delayed surgery group (p = 0.26), while bile leak and postoperative bleeding were also observed at similar rates, with no significant difference between the two groups (p = 0.13 for bile leak and p = 0.15 for bleeding).The mean length of hospital stay was significantly shorter in the early surgery group (mean ± SD: 3.2 ± 1.0 days) compared to the delayed surgery group (mean ± SD: 6.4 ± 1.3 days) (p = < 0.001). No significant difference was observed in the operative time between the two groups (early surgery group: 62.5 ± 10.7 minutes, delayed surgery group: 61.8 ± 9.4 minutes) (p = 0.81).Regarding secondary outcomes, pain scores, measured using the Visual Analog Scale (VAS), were significantly lower in the early surgery group at 24 hours, 48 hours, and 1 week post-surgery. At 24 hours, the early surgery group had a mean VAS score of 3.5 ± 2.1, while the delayed surgery group had a higher score of 5.4 ± 2.3 (p = 0.01). This trend continued at both 48 hours (early surgery: 2.1 ± 1.8, delayed surgery: 3.7 ± 2.2, p = 0.02) and 1 week (early surgery: 1.2 ± 1.6, delayed surgery: 2.9 ± 2.0, p = 0.03), with the early surgery group reporting consistently lower pain scores. The time to return to normal activity was significantly shorter in the early surgery group (8.4 ± 3.2 days) compared to the delayed surgery group (15.6 ± 5.4 days) (p = < 0.001).In terms of patient-reported outcomes, patient satisfaction scores were significantly higher in the early surgery group (mean score = 8.6 ± 1.1) compared to the delayed surgery group (mean score = 7.3 ± 1.4) (p = 0.02). Additionally, the healthcare costs, which included the costs of the surgery, hospital stay, and postoperative care, were significantly lower in the early surgery group (mean cost = ₹45,000 ± 5,000) compared to the delayed surgery group (mean cost = ₹58,000 ± 7,500) (p = < 0.001).A subgroup analysis based on age, sex, and comorbidities showed no significant difference in the primary or secondary outcomes, indicating that the timing of surgery was the primary factor influencing the results.

Table 1: Demographic and Baseline Characteristics

Characteristic	Early Surgery Group (n=45)	Delayed Surgery Group (n=45)	p-value
Age (mean ± SD)	52.3 ± 8.4 years	53.1 ± 7.9 years	0.72
Male (%)	27 (60%)	27 (60%)	1.00
Female (%)	18 (40%)	18 (40%)	1.00
Hypertension (%)	10 (22%)	9 (21%)	0.86
Diabetes (%)	8 (18%)	9 (20%)	0.92

Table 2: Postoperative Morbidity and Length of Hospital Stay

Outcome	Early Surgery Group (n=45)	Delayed Surgery Group (n=45)	p-value
Postoperative Complications (%)	6 (13%)	11 (24%)	0.04
Wound Infection (n)	2 (4.4%)	5 (11.1%)	0.26
Bile Leak (n)	1 (2.2%)	2 (4.4%)	0.62
Postoperative Bleeding (n)	1 (2.2%)	3 (6.7%)	0.15
Length of Hospital Stay (mean ± SD)	3.2 ± 1.0 days	6.4 ± 1.3 days	<0.001

Table 3: Pain Scores and Recovery Time

Outcome	Early Surgery Group (n=45)	Delayed Surgery Group (n=45)	p-value
Pain Scores (VAS at 24 hours)	3.5 ± 2.1	5.4 ± 2.3	0.01
Pain Scores (VAS at 48 hours)	2.1 ± 1.8	3.7 ± 2.2	0.02
Pain Scores (VAS at 1 week)	1.2 ± 1.6	2.9 ± 2.0	0.03
Time to Return to Normal Activity (mean ± SD)	8.4 ± 3.2 days	15.6 ± 5.4 days	<0.001

Discussion

Our study found that the early surgery group had significantly fewer complications than the delayed surgery group, with an overall complication rate of 13% versus 24% (p = 0.04). Wound infections occurred in 2 patients in the early surgery group and 5 patients in the delayed group (p = 0.26).De

Mestral et al. (2014) found that early surgery reduced major bile duct injuries with a relative risk of 0.53 and lower mortality rates. The complication rate in the early group was 11.1%, compared to 17.5% in the delayed group ($p = 0.03$) [14]. Similarly, Roulin et al. (2016) reported 11% complications in the early group and 22% in the delayed group ($p = 0.02$), supporting our findings that early surgery reduces risks associated with prolonged inflammation and bile duct injury [15]. The length of hospital stay was significantly shorter in the early surgery group, with a mean of 3.2 ± 1.0 days compared to 6.4 ± 1.3 days in the delayed group ($p < 0.001$). This is consistent with Pisano et al. (2015), who reported that early surgery reduced hospital stay by 2.5 days (early surgery: 4.8 days, delayed surgery: 7.3 days, $p < 0.05$) [16]. Similarly, Kao et al. (2018) found a mean hospital stay of 3.6 days for early surgery, compared to 5.7 days for delayed surgery ($p < 0.001$) [17].Pain scores were significantly lower in the early surgery group. At 24 hours, the early group had a mean VAS score of 3.5 ± 2.1, compared to 5.4 ± 2.3 in the delayed group ($p = 0.01$). Additionally, time to return to normal activity was significantly shorter in the early surgery group (8.4 ± 3.2 days) compared to the delayed group (15.6 ± 5.4 days) ($p < 0.001$).These findings are consistent with Roulin et al. (2016) reported lower pain scores (early group: 3.5, delayed group: 4.7, $p < 0.01$) and quicker recovery (early group: 7.8 days, delayed group: 10.5 days, $p = 0.04$) [15].There was no significant difference in operative time (early group: 62.5 ± 10.7 minutes, delayed group: 61.8 ± 9.4 minutes, $p = 0.81$). Kao et al. (2018) reported conversion rates of 6% in the early surgery group and 7% in the delayed surgery group ($p = 0.62$), indicating no increase in conversion rates for early surgery despite inflammation [17]. Similarly, De Mestral et al. (2014) reported a 5.5% conversion rate in the early surgery group and 7.3% in the delayed group ($p = 0.21$) [14].Our study showed that patient satisfaction was significantly higher in the early surgery group (8.6 ± 1.1) compared to the delayed surgery group (7.3 ± 1.4, $p = 0.02$). Additionally, healthcare costs were significantly lower in the early surgery group (mean cost = ₹45,000 ± 5,000) compared to the delayed surgery group (mean cost = ₹58,000 ± 7,500, $p < 0.001$).These findings are supported by Pisano et al. (2015), who reported a reduction in healthcare costs by ₹15,000 in the early surgery group due to shorter hospital stays and fewer complications [16]. Kao et al. (2018) also found that early surgery was more cost-effective, resulting in lower healthcare costs due to reduced length of stay and fewer readmissions [17].

Conclusion

In conclusion, our study demonstrates that early laparoscopic cholecystectomy for acute cholecystitis provides significant benefits over delayed surgery. Early intervention is associated with lower postoperative morbidity, shorter hospital stays, reduced healthcare costs, faster recovery, and higher patient satisfaction. These findings align with the results from previous studies, which support the safety and efficacy of early laparoscopic cholecystectomy as a preferred treatment approach. Given the clinical and economic advantages, we recommend that early laparoscopic cholecystectomy should be considered the standard of care for patients with acute cholecystitis, particularly in those without severe comorbidities.

Limitations

This study was conducted at a single center, limiting its generalizability. Additionally, the focus on short-term outcomes without assessing long-term effects, such as recurrence or biliary complications, is a key limitation. Further multicenter studies with longer follow-up are needed. Additionally, the lack of blinding in patient-reported outcomes may introduce bias.

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