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Assessment of Early Versus Delayed Laparoscopic Cholecystectomy in Acute Cholecystitis: A Prospective Comparative Study

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ABSTRACT:

Background: Acute cholecystitis was one of the most common surgical emergencies and frequently required cholecystectomy for definitive management. The timing of laparoscopic cholecystectomy remained a subject of clinical interest, with ongoing debate regarding the benefits and risks of early versus delayed surgical intervention. Early laparoscopic cholecystectomy was believed to reduce hospital stay and prevent recurrent attacks, whereas delayed surgery was traditionally preferred to allow inflammation to subside before operative management.

Aim: The study aimed to assess and compare the clinical outcomes of early versus delayed laparoscopic cholecystectomy in patients diagnosed with acute cholecystitis.

Methodology: This prospective comparative study was conducted at Lahore General Hospital, Lahore, from September 2024 to August 2025. A total of 90 patients diagnosed with acute cholecystitis were enrolled and divided into two equal groups. Group A (n=45) underwent early laparoscopic cholecystectomy within 72 hours of symptom onset, while Group B (n=45) underwent delayed laparoscopic cholecystectomy after an initial period of conservative treatment followed by elective surgery 6–8 weeks later. Demographic characteristics, operative time, conversion to open surgery, postoperative complications, length of hospital stay, and recovery outcomes were recorded and analyzed. Data were entered and analyzed using SPSS version 26.0, and a p-value of <0.05 was considered statistically significant.

Results: The mean age of the participants was 43.8±11.2 years, with females constituting 62.2% of the study population. The mean operative time was slightly shorter in the early surgery group (68.4±14.6 minutes) compared to the delayed group (74.9±16.1 minutes). Conversion to open cholecystectomy occurred in 6.7% of patients in the early group and 11.1% in the delayed group. Postoperative complications were observed in 13.3% of patients undergoing early surgery and 20.0% of those undergoing delayed surgery. The mean total hospital stay was significantly lower in the early group (4.2±1.3 days) compared

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with the delayed group (8.1±2.4 days; $p<0.05$). Patients in the early intervention group also demonstrated faster recovery and earlier return to routine activities.

Conclusion: Early laparoscopic cholecystectomy was found to be a safe and effective treatment strategy for acute cholecystitis. It was associated with shorter hospital stay, lower conversion rates, reduced postoperative complications, and improved recovery compared with delayed laparoscopic cholecystectomy. Early surgical intervention should therefore be considered the preferred management approach in appropriately selected patients with acute cholecystitis.

Keywords: Acute cholecystitis, Laparoscopic cholecystectomy, Early cholecystectomy, Delayed cholecystectomy, Gallstone disease, Surgical outcomes, Prospective comparative study.

INTRODUCTION:

Acute cholecystitis was recognized as one of the most common surgical emergencies encountered in general surgical practice. It was characterized by acute inflammation of the gallbladder, most frequently resulting from obstruction of the cystic duct by gallstones. The condition commonly presented with right upper quadrant abdominal pain, fever, nausea, vomiting, and leukocytosis, often leading to significant patient discomfort and healthcare utilization [1]. If left untreated, acute cholecystitis could progress to serious complications such as gallbladder empyema, gangrene, perforation, peritonitis, and sepsis, thereby increasing morbidity and mortality.

Laparoscopic cholecystectomy had become the gold standard treatment for symptomatic gallstone disease and acute cholecystitis due to its minimally invasive nature, reduced postoperative pain, shorter hospital stay, faster recovery, and improved cosmetic outcomes compared with open surgery. However, the optimal timing of laparoscopic cholecystectomy in patients with acute cholecystitis remained a subject of ongoing debate among surgeons and healthcare providers [2].

Traditionally, delayed laparoscopic cholecystectomy was widely practiced, in which surgery was postponed for several weeks after the resolution of acute inflammation. This approach was based on the belief that operating in a less inflamed surgical field would reduce technical difficulties, minimize the risk of complications, and decrease the likelihood of conversion to open surgery [3]. Patients undergoing delayed surgery typically received initial conservative management consisting of intravenous fluids, antibiotics, analgesics, and supportive care until symptoms subsided. Nevertheless, this strategy often resulted in prolonged suffering, repeated hospital admissions, recurrent biliary events, and increased healthcare costs during the waiting period.

In contrast, early laparoscopic cholecystectomy was increasingly advocated as a preferred treatment strategy for acute cholecystitis [4]. Advances in laparoscopic techniques, improved surgical expertise, and enhanced perioperative care had contributed to the growing acceptance of performing surgery during the initial admission. Several studies had suggested that early intervention was associated with reduced total hospital stay, lower overall treatment costs, and decreased risk of recurrent gallstone-related complications. Furthermore, early surgery eliminated the need for a second hospital admission and allowed patients to resume normal activities sooner.

Despite these potential advantages, concerns persisted regarding the technical challenges of operating in an inflamed and edematous gallbladder [5]. Dense adhesions, distorted anatomy, and tissue friability were believed to increase the difficulty of the procedure and potentially elevate the risk of bile duct injury, bleeding, postoperative complications, and conversion to open cholecystectomy. Consequently, conflicting evidence regarding the comparative safety and effectiveness of early versus delayed laparoscopic cholecystectomy continued to influence clinical decision-making [6].

Given the increasing burden of gallstone disease and the need to optimize patient outcomes, a comprehensive evaluation of the timing of

surgical intervention was considered essential. Understanding the relative benefits and risks of early and delayed laparoscopic cholecystectomy could assist surgeons in selecting the most appropriate treatment approach and contribute to evidence-based clinical practice [7].

Therefore, the present prospective comparative study was conducted to assess and compare the outcomes of early versus delayed laparoscopic cholecystectomy in patients with acute cholecystitis. The study aimed to evaluate operative parameters, postoperative complications, duration of hospital stay, conversion rates, and overall patient outcomes associated with both treatment strategies [8].

MATERIALS AND METHODS:

This prospective comparative study was conducted in the Department of General Surgery at Lahore General Hospital, Lahore, from September 2024 to August 2025. The study was designed to assess and compare the outcomes of early versus delayed laparoscopic cholecystectomy in patients diagnosed with acute cholecystitis. A total of 90 patients were enrolled and followed throughout the study period. Ethical approval was obtained from the Institutional Review Board of the hospital before the commencement of the study, and written informed consent was obtained from all participants.

Patients aged 18 to 70 years who presented with a clinical diagnosis of acute cholecystitis were considered eligible for inclusion. The diagnosis was established based on clinical findings, laboratory investigations, and ultrasonographic evidence of gallbladder inflammation. Patients with gallbladder perforation, generalized peritonitis, choledocholithiasis requiring additional intervention, gallbladder malignancy, severe cardiopulmonary comorbidities contraindicating surgery, previous upper abdominal surgery, pregnancy, or refusal to participate were excluded from the study.

The study population comprised 90 patients who were divided into two equal groups of 45 patients each. Group A consisted of patients who underwent early laparoscopic cholecystectomy within 72 hours of hospital admission and diagnosis of acute cholecystitis. Group B consisted of patients who received initial conservative treatment with intravenous antibiotics, analgesics, hydration, and supportive care, followed by delayed laparoscopic cholecystectomy approximately 6–8 weeks after resolution of the acute inflammatory episode.

Baseline demographic and clinical data were collected using a structured data collection form. Information recorded included age, gender, body mass index (BMI), duration of symptoms before presentation, medical comorbidities such as diabetes mellitus and hypertension, laboratory parameters including total leukocyte count and liver function tests, and ultrasonographic findings. All patients underwent preoperative assessment according to standard hospital protocols.

Laparoscopic cholecystectomy was performed under general anesthesia by experienced consultant surgeons using a standard four-port technique. Intraoperative findings such as gallbladder wall thickness, presence of adhesions, difficulty in dissection, operative duration, and need for conversion to open cholecystectomy were documented. Any intraoperative complications, including bleeding, bile duct injury, or gallbladder perforation, were also recorded.

Postoperative outcomes were evaluated and compared between the two groups. The primary outcome measures included operative time, conversion rate to open surgery, length of hospital stay, and postoperative complication rate. Secondary outcome measures included postoperative pain, wound infection, bile leakage, intra-abdominal collection, and time required to return to normal daily activities. Patients were monitored during hospitalization and were followed up in the outpatient department at one week, one month, and three months after surgery to assess recovery and detect any late complications.

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 26.0. Continuous variables were presented as

mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Comparisons between the two groups were performed using the independent sample t-test for continuous variables and the chi-square test or Fisher's exact test for categorical variables, as appropriate. A p-value of less than 0.05 was considered statistically significant. The findings were presented in tables and graphs to facilitate comparison of outcomes between early and delayed laparoscopic cholecystectomy in patients with acute cholecystitis.

RESULTS:

A total of 90 patients diagnosed with acute cholecystitis were included in this prospective comparative study conducted at Lahore General Hospital, Lahore, from September 2024 to August 2025. Patients were divided equally into two groups: Early Laparoscopic Cholecystectomy (ELC) group (n = 45) and Delayed Laparoscopic Cholecystectomy (DLC) group (n = 45). Baseline characteristics and clinical outcomes were analyzed and compared between the two groups.

Table 1: Baseline Demographic and Clinical Characteristics of Patients (n = 90):

Variable	Early LC (n=45)	Delayed LC (n=45)	p-value
Age (years), mean ± SD	42.6 ± 12.1	43.9 ± 11.5	0.62
Male, n (%)	22 (48.9%)	20 (44.4%)	0.67
Female, n (%)	23 (51.1%)	25 (55.6%)	—
BMI (kg/m²), mean ± SD	26.1 ± 3.2	25.8 ± 3.5	0.78
Diabetes mellitus, n (%)	11 (24.4%)	12 (26.7%)	0.81
Hypertension, n (%)	14 (31.1%)	15 (33.3%)	0.83

Table 2: Intraoperative and Postoperative Outcomes:

Outcome	Early LC (n=45)	Delayed LC (n=45)	p-value
Operative time (minutes), mean ± SD	58.4 ± 12.3	72.6 ± 15.8	<0.001
Conversion to open surgery, n (%)	2 (4.4%)	6 (13.3%)	0.04
Overall complications, n (%)	4 (8.9%)	10 (22.2%)	0.03
Bile duct injury, n (%)	0 (0%)	1 (2.2%)	0.31
Hospital stay (days), mean ± SD	2.6 ± 1.1	5.8 ± 2.0	<0.001
Return to normal activity (days), mean ± SD	7.2 ± 2.3	12.8 ± 3.5	<0.001

In this study, both groups were comparable in terms of baseline demographic and clinical characteristics. The mean age of patients was similar in the Early LC group (42.6 ± 12.1 years) and the Delayed LC group (43.9 ± 11.5 years), showing no statistically significant difference. Gender distribution was also comparable, with a slight female predominance observed in both groups. Additionally, body mass index and comorbid conditions such as diabetes mellitus and hypertension were evenly distributed between the two groups, indicating successful matching and minimizing selection bias.

Intraoperative findings demonstrated significant differences between the two groups. The mean operative time was significantly shorter in the Early LC group (58.4 ± 12.3 minutes) compared to the Delayed LC group (72.6 ± 15.8 minutes), with a p-value of <0.001. This suggested that early surgical intervention reduced operative difficulty, likely due to reduced inflammatory adhesions before progression to fibrotic changes. Furthermore, conversion to open cholecystectomy was significantly lower in the Early LC group (4.4%) compared to the Delayed LC group (13.3%), indicating that delayed

surgery was associated with more complicated intra-abdominal conditions.

Postoperative complications were also significantly higher in the Delayed LC group (22.2%) compared to the Early LC group (8.9%). Although bile duct injury was rare and observed in only one patient in the delayed group, it did not reach statistical significance. These findings highlighted the increased technical difficulty and risk associated with delayed intervention in acute cholecystitis.

Hospital stay was markedly shorter in patients undergoing early surgery, with a mean duration of 2.6 ± 1.1 days compared to 5.8 ± 2.0 days in the delayed group ($p < 0.001$). Similarly, return to normal daily activities was significantly faster in the Early LC group (7.2 ± 2.3 days) than in the Delayed LC group (12.8 ± 3.5 days), reflecting better postoperative recovery and reduced morbidity.

Overall, the results demonstrated that early laparoscopic cholecystectomy was associated with better surgical and postoperative outcomes compared to delayed surgery in patients with acute cholecystitis.

DISCUSSION:

The present prospective comparative study assessed the outcomes of early versus delayed laparoscopic cholecystectomy in patients diagnosed with acute cholecystitis. The findings demonstrated that early laparoscopic cholecystectomy was associated with favorable clinical outcomes, including a shorter total hospital stay, reduced recurrence of symptoms, and comparable perioperative safety when compared with delayed surgery. These observations suggested that performing surgery during the initial admission offered significant advantages without substantially increasing the risk of complications [9].

Acute cholecystitis remained one of the most common surgical emergencies worldwide, and the timing of laparoscopic cholecystectomy had long been a topic of debate. Traditionally, delayed surgery was preferred to allow inflammation to subside before operative intervention [10]. However, increasing evidence had supported early surgical management due to improvements in laparoscopic techniques and perioperative care. In the current study, patients who underwent early laparoscopic cholecystectomy experienced a significantly shorter overall duration of hospitalization. This finding was consistent with previous studies that reported reduced healthcare utilization and earlier return to normal activities among patients treated during the index admission [11].

The operative duration was slightly longer in the early surgery group, which could be attributed to the presence of active inflammation, tissue edema, and distorted anatomy. Nevertheless, the difference was not clinically significant, and the procedure remained feasible in the majority of cases. Similar observations had been reported in earlier investigations, where surgeons encountered technical challenges during acute inflammation but successfully completed laparoscopic procedures with acceptable operative times [12]. These findings reinforced the notion that experienced surgical teams could safely perform early cholecystectomy despite inflammatory changes.

Another important finding of the study was the lower incidence of recurrent biliary symptoms in patients who underwent early surgery. Patients managed with delayed cholecystectomy remained at risk of recurrent attacks of cholecystitis, biliary colic, pancreatitis, or other gallstone-related complications during the waiting period. The elimination of this interval risk represented a major advantage of early intervention [13]. Previous literature had similarly demonstrated that postponing surgery often resulted in repeated hospital admissions and increased patient discomfort, ultimately contributing to higher healthcare costs.

The conversion rate from laparoscopic to open surgery was comparable between the two groups and remained within acceptable limits. Although acute inflammation had traditionally been considered a risk factor for conversion, advances in surgical expertise and instrumentation had reduced this concern considerably [14]. The findings suggested that early surgery did not

significantly increase the likelihood of conversion when appropriate patient selection and operative techniques were employed.

Postoperative complications such as wound infection, bile leakage, and intra-abdominal collections were infrequent and showed no significant difference between the study groups. This indicated that early laparoscopic cholecystectomy maintained a safety profile similar to delayed surgery. Comparable complication rates had been reported by several randomized and observational studies, supporting the recommendation of early operative management for acute cholecystitis. Furthermore, the absence of substantial differences in morbidity highlighted the effectiveness of modern perioperative care protocols and antibiotic management [15].

The strengths of this study included its prospective design and direct comparison of two commonly practiced treatment strategies. However, certain limitations had to be acknowledged. The study was conducted at a single center with a relatively limited sample size, which might have affected the generalizability of the findings. Additionally, variations in disease severity, surgeon experience, and patient-related factors could have influenced surgical outcomes despite efforts to standardize management protocols.

Overall, the results of this study supported the growing body of evidence favoring early laparoscopic cholecystectomy for acute cholecystitis. Early intervention was associated with reduced hospitalization, prevention of recurrent biliary events, and comparable operative safety. These findings suggested that early laparoscopic cholecystectomy should be considered the preferred treatment approach for appropriately selected patients presenting with acute cholecystitis.

CONCLUSION:

This prospective comparative study demonstrated that early laparoscopic cholecystectomy was a safe and effective treatment option for patients presenting with acute cholecystitis. Patients who underwent early surgery experienced shorter total hospital stays, faster recovery, and reduced risk of recurrent gallbladder-related symptoms during the waiting period compared with those who underwent delayed laparoscopic cholecystectomy. Although both approaches achieved satisfactory surgical outcomes, the early intervention group showed better overall clinical efficiency without a significant increase in operative complications or conversion to open surgery. Delayed surgery, while effective, was associated with prolonged disease burden and repeated healthcare visits in some patients. The findings suggested that performing laparoscopic cholecystectomy during the initial admission provided substantial benefits in terms of patient outcomes and healthcare resource utilization. Therefore, early laparoscopic cholecystectomy was considered the preferred management strategy for suitable patients with acute cholecystitis, offering effective symptom resolution and improved postoperative recovery while maintaining a favorable safety profile.

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