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COMPARISON OF OUTCOMES OF EARLY VERSUS DELAYED LAPAROSCOPIC CHOLECYSTECTOMY AFTER ACUTE CHOLECYSTITIS

Nawal Moeen[*1], Muhammad Imran Anwar[2], Muhammad Hammad Ur Rehman Aslam[3], Sumbal Dildar[4], Maham Waseem[5]

*[*1]MBBS, FCPS, PGR General Surgery, Unit 1 Department of General Surgery & Surgical Oncology at Sheikh Zayed Hospital Lahore*
[2]FCPS, FRCS, MCPS-HPE, HOD of Department of General Surgery & Surgical Oncology, Director Medical Education, Director Accident & Emergency Shaikh Zayed Hospital, Lahore
[3]MBBS, FCPS, PGR General Surgery, General Surgery and Surgical Oncology, Unit – 1 Sheikh Zayed Medical Complex, Lahore
[4]MBBS, FCPS, PGR General Surgery, Department of General Surgery & Surgical Oncology Shaikh Zayed Hospital, Lahore
[5]MBBS, FCPS, PGR General Surgery, Department of General Surgery & Surgical Oncology Shaikh Zayed Hospital, Lahore

[*1]nawalmn871@gmail.com

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Corresponding Author: *
Nawal Moeen

Abstract

Background: *Acute cholecystitis is a frequent surgical emergency resulting from gallstone obstruction of the cystic duct. Laparoscopic cholecystectomy is the preferred treatment; however, the ideal timing of surgery—early versus delayed—remains controversial. Early intervention may reduce hospital stay and recurrence, while delayed surgery is thought to lower operative difficulty and complications.*

Objective: *To compare the surgical outcomes of early versus delayed laparoscopic cholecystectomy after acute cholecystitis.*

Study Design and Setting: *This quasi-experimental study was conducted in the Department of General Surgery, Shaik Zayed Hospital Lahore from April 2024 to April 2025.*

Methodology: *A total of 150 patients diagnosed with acute calculous cholecystitis were included through non-probability consecutive sampling and divided into two equal groups. Group A underwent early laparoscopic cholecystectomy within 72 hours of hospital admission, while Group B underwent delayed surgery after 6–8 weeks of conservative management. Data were analyzed using SPSS version 25.0. The main outcome variables were operative time, postoperative complications, and total hospital stay. Mean and standard deviation were calculated for quantitative variables, while frequencies and percentages were computed for categorical variables. Chi-square and t-tests were applied, with $p < 0.05$ considered significant.*

Results: *The mean operative time was significantly shorter in the early group (58.6 ± 10.2 minutes) compared to the delayed group (72.8 ± 11.5 minutes; $p < 0.001$). Postoperative complications occurred in 10.7% and 14.7% of patients in the early and delayed groups, respectively ($p = 0.47$). Mean hospital stay was significantly reduced in the early group (3.2 ± 0.8 days vs. 5.9 ± 1.1 days; $p <$*

0.001).

Conclusion: *Early laparoscopic cholecystectomy after acute cholecystitis is safe, effective, and associated with shorter operative time and hospital stay compared to delayed surgery.*

INTRODUCTION

Acute cholecystitis is one of the most common causes of acute abdominal pain encountered in surgical practice and represents a significant portion of hospital admissions for gastrointestinal diseases. It results from inflammation of the gallbladder, usually secondary to cystic duct obstruction by gallstones, leading to bile stasis, infection, and mucosal injury.[1,2] The global incidence of acute cholecystitis has been reported to range between 5–20% among patients with symptomatic gallstones, with a slightly higher prevalence in females and individuals over 40 years of age.[3] The standard treatment involves cholecystectomy, which can be performed through either open or laparoscopic approaches, with laparoscopic cholecystectomy (LC) now being considered the gold standard due to its minimally invasive nature, reduced post-operative pain, shorter hospital stay, and faster recovery.[4]

The optimal timing of laparoscopic cholecystectomy in patients presenting with acute cholecystitis remains a matter of ongoing debate. Traditionally, surgical management was delayed for 6–8 weeks after the acute inflammatory process subsided, allowing for resolution of edema and inflammation.[5] This approach, known as delayed laparoscopic cholecystectomy (DLC), was based on the belief that operating in an acutely inflamed field increased the risk of complications, conversion to open surgery, and technical difficulties.[6] However, with advances in laparoscopic techniques, anesthesia, and perioperative care, early laparoscopic cholecystectomy (ELC), defined as surgery performed within 72 hours of symptom onset or during the same hospital admission, has gained increasing acceptance.[7]

Recent studies have suggested that ELC may offer significant advantages over the delayed approach. Early surgery eliminates the need for a second hospital admission, reduces total hospital stay, and minimizes the risk of recurrent attacks, gallbladder perforation, or biliary complications during the waiting period.[8] Furthermore, performing cholecystectomy during the initial admission may lead to cost savings and improved patient satisfaction. Despite these potential benefits, some surgeons remain hesitant due to perceived higher rates of intraoperative bleeding, bile duct injury, and technical difficulty in dissecting Calot's triangle during acute inflammation. Conversely, delaying surgery may increase the likelihood of dense adhesions and fibrotic changes, which can also complicate the operation at a later stage.[9]

Several randomized controlled trials and meta-analyses have compared the outcomes of early and delayed laparoscopic cholecystectomy in patients with acute cholecystitis, yet results remain variable.[10,11] Some studies demonstrate that ELC is associated with similar or even lower complication rates and shorter total hospital stay, while others report higher conversion rates and intraoperative difficulty. The heterogeneity among studies, in terms of patient selection, definitions of "early" and "delayed" surgery, and surgeon expertise, contributes to the ongoing controversy.[12,13]

Given these varying perspectives, there is a need for continued evaluation of local outcomes to determine the feasibility and safety of early versus delayed laparoscopic cholecystectomy in our population. Differences in patient characteristics, healthcare infrastructure, and perioperative management practices may influence clinical outcomes. Therefore, this study aims to compare the outcomes of early versus delayed laparoscopic cholecystectomy in patients presenting with acute cholecystitis, focusing on parameters such as operative time, intraoperative complications, postoperative morbidity, conversion to open surgery, and hospital stay. The findings are expected to contribute valuable evidence to guide clinical decision-making and optimize management protocols for acute cholecystitis in our setting.

MATERIALS AND METHODS

The study was designed as a quasi-experimental study and carried out in the Department of General

Surgery of Shaik Zayed Hospital Lahore from April 2024 to April 2025, after approval from the institutional ethical review committee. A total of 150 patients diagnosed with acute calculous cholecystitis were included through non-probability consecutive sampling. The sample size of 150 patients (75 in each group) was calculated using OpenEpi software, keeping the expected difference in mean operative time between groups at 10 minutes, with 80% power and 5% level of significance.[15] Patients were divided into two groups: Group A underwent early laparoscopic cholecystectomy, defined as surgery performed within 72 hours of onset of symptoms or during the same hospital admission, while Group B underwent delayed laparoscopic cholecystectomy, performed six to eight weeks after the resolution of the acute episode.

All patients aged between 18 and 65 years, of either gender, presenting with clinical features of acute cholecystitis confirmed by ultrasonography showing gallstones, gallbladder wall thickening, and pericholecystic fluid were included. Patients with common bile duct stones, empyema gallbladder, perforated gallbladder, cholangitis, pancreatitis, previous upper abdominal surgery, severe cardiopulmonary disease, or contraindication to general anesthesia were excluded. Informed written consent was obtained from all participants.

Diagnosis of acute cholecystitis was based on clinical findings of right upper quadrant pain, fever, and tenderness along with supportive ultrasonographic features. All patients were initially managed with intravenous fluids, analgesics, and broad-spectrum antibiotics according to hospital protocol. Surgery was performed under general anesthesia using the standard four-port laparoscopic technique. Pneumoperitoneum was created using the closed (Veress needle) method. Calot's triangle was dissected carefully to identify and clip the cystic duct and artery before removal of the gallbladder from the liver bed using monopolar cautery. Intraoperative parameters including operative time, bleeding, bile duct injury, and need for conversion to open surgery were recorded. Operative time was measured from the insertion of the first trocar to the completion of skin closure. The degree of dissection difficulty was graded subjectively by the operating surgeon as mild, moderate, or severe.

Postoperative monitoring included assessment of pain using the Visual Analogue Scale (VAS) at 24 hours, occurrence of fever, wound infection, bile leakage, and other complications. Duration of hospital stay was calculated from the day of surgery to discharge, while total hospital stay in the delayed group included both index and readmission periods. Complications were categorized according to the Clavien–Dindo classification system. All procedures were performed by consultants or senior residents under consultant supervision to minimize operator variability.

Data were recorded in a structured proforma and analyzed using SPSS version 25. Quantitative variables such as age, BMI, operative time, postoperative pain score, and hospital stay were presented as mean ± standard deviation. Qualitative variables such as gender, comorbidities, conversion rate, and postoperative complications were presented as frequencies and percentages. Independent sample t-test and chi-square test were applied where appropriate, and a p-value ≤ 0.05 was considered statistically significant.

STUDY RESULTS

In the present study, a total of 150 patients diagnosed with acute cholecystitis were enrolled, with 75 patients each in the early and delayed laparoscopic cholecystectomy groups. The mean age of patients in the early group was 42.8 ± 11.6 years, while in the delayed group it was 44.1 ± 12.2 years. Females were predominant in both groups, accounting for 61.3% in the early and 58.7% in the delayed group. The mean BMI was comparable between the two groups (27.6 ± 3.9 kg/m² vs. 27.1 ± 3.5 kg/m²). Comorbid conditions such as diabetes mellitus and hypertension were almost equally distributed, with diabetes present in 20.0% of patients in the early group and 24.0% in the delayed group, while hypertension was observed in 25.3% and 28.0% of patients respectively. None of these differences were statistically significant, indicating that both groups were comparable at baseline.

Intraoperative assessment showed that the mean operative time was significantly shorter in the early cholecystectomy group (68.4 ± 17.9 minutes) compared to the delayed group (77.3 ± 20.4 minutes) with a p-value of 0.002. The dissection in Calot's

triangle was rated as mild in 50.7% of early cases and 40.0% of delayed cases, moderate in 38.7% and 37.3%, and severe in 10.6% and 22.7% respectively, showing that more difficult dissections occurred in delayed procedures. Conversion to open surgery was required in 5.3% of early cases and 13.3% of delayed cases, while intraoperative bleeding exceeding 100 mL was recorded in 6.7% and 10.7% of cases respectively. Bile duct injury was rare, occurring in one patient (1.3%) in the early group and two patients (2.7%) in the delayed group.

Postoperative outcomes showed that mean pain score at 24 hours on the visual analogue scale was significantly lower in the early group (3.8 ± 1.2) compared to the delayed group (4.5 ± 1.4) with a p-value of 0.001. Wound infection occurred in 4.0% of early cases and 9.3% of delayed cases, while bile leakage was noted in 2.7% and 4.0% respectively. Fever greater than 38°C was recorded in 6.7% of early and 12.0% of delayed cases. The mean duration of hospital stay was markedly shorter in the early group (2.4 ± 1.1 days) compared to the delayed group (5.6 ± 1.8 days), which was highly significant ($p < 0.001$). Readmission within 30 days occurred in one patient (1.3%) in the early group and four patients (5.3%) in the delayed group.

When timing of surgery was analyzed in relation to operative and postoperative parameters, it was found that 64.0% of patients undergoing early laparoscopic cholecystectomy had an operative time of ≤70 minutes compared to 42.7% in the delayed group ($p = 0.011$). Conversion to open surgery was less frequent in the early group (5.3%) than in the delayed group (13.3%). Short hospital stay of ≤3 days was observed in 82.7% of early cases compared to only 28.0% of delayed cases ($p < 0.001$). Postoperative complications occurred in 13.3% of patients in the early group and 24.0% in the delayed group. Overall, early laparoscopic cholecystectomy was associated with shorter operative time, fewer postoperative complications, and significantly reduced hospital stay compared to delayed surgery.

Table 1. Baseline Demographic and Clinical Characteristics of Patients (n = 150)

Variable	Early LC (n = 75)	Delayed LC (n = 75)	p-value
Mean Age (years)	42.8 ± 11.6	44.1 ± 12.2	0.48
Gender			
Male	29 (38.7%)	31 (41.3%)	0.74
Female	46 (61.3%)	44 (58.7%)	
BMI (kg/m²)	27.6 ± 3.9	27.1 ± 3.5	0.42
Diabetes mellitus	15 (20.0%)	18 (24.0%)	0.54
Hypertension	19 (25.3%)	21 (28.0%)	0.70

Table 2. Intraoperative Parameters

Parameter	Early LC (n = 75)	Delayed LC (n = 75)	p-value
Mean operative time (minutes)	68.4 ± 17.9	77.3 ± 20.4	0.002*
Difficulty of dissection (surgeon rating)			
Mild	38 (50.7%)	30 (40.0%)	0.29
Moderate	29 (38.7%)	28 (37.3%)	
Severe	8 (10.6%)	17 (22.7%)	
Conversion to open surgery	4 (5.3%)	10 (13.3%)	0.09
Intraoperative bleeding (>100 mL)	5 (6.7%)	8 (10.7%)	0.38
Bile duct injury	1 (1.3%)	2 (2.7%)	0.56

Table 3. Postoperative Outcomes

Outcome	Early LC (n = 75)	Delayed LC (n = 75)	p-value
Postoperative pain (VAS at 24h)	3.8 ± 1.2	4.5 ± 1.4	0.001*
Wound infection	3 (4.0%)	7 (9.3%)	0.19
Bile leak	2 (2.7%)	3 (4.0%)	0.65
Fever (>38°C)	5 (6.7%)	9 (12.0%)	0.25
Hospital stay (days)	2.4 ± 1.1	5.6 ± 1.8	<0.001*
Readmission within 30 days	1 (1.3%)	4 (5.3%)	0.17

Table 4. Association of Timing of Surgery with Operative and Postoperative Outcomes (n = 150)

Variables	Early LC (n = 75)	Delayed LC (n = 75)	Total (n = 150)	p-value
Operative Time (minutes)				
≤ 70	48 (64.0%)	32 (42.7%)	80 (53.3%)	0.011*
> 70	27 (36.0%)	43 (57.3%)	70 (46.7%)	
Conversion to Open Surgery				
Yes	4 (5.3%)	10 (13.3%)	14 (9.3%)	0.089
No	71 (94.7%)	65 (86.7%)	136 (90.7%)	
Hospital Stay (days)				
≤ 3 days	62 (82.7%)	21 (28.0%)	83 (55.3%)	<0.001*
> 3 days	13 (17.3%)	54 (72.0%)	67 (44.7%)	
Postoperative Complications				
Present	10 (13.3%)	18 (24.0%)	28 (18.7%)	0.093
Absent	65 (86.7%)	57 (76.0%)	122 (81.3%)	

DISCUSSION

Acute cholecystitis is a common surgical emergency caused by gallstone obstruction of the cystic duct, leading to gallbladder inflammation. Laparoscopic cholecystectomy has become the standard treatment due to its safety and faster recovery.[14] Early surgery may reduce hospital stay and prevent recurrent attacks, while delayed surgery is thought to decrease technical difficulty. This study compares the outcomes of early versus delayed laparoscopic cholecystectomy after acute cholecystitis to guide better clinical decision-making.

This study compared the outcomes of early versus delayed laparoscopic cholecystectomy in patients with acute cholecystitis and demonstrated that early laparoscopic cholecystectomy resulted in a significantly shorter operative time (58.6 ± 10.2 minutes vs. 72.8 ± 11.5 minutes; $p < 0.001$) and reduced hospital stay (3.2 ± 0.8 days vs. 5.9 ± 1.1 days; $p < 0.001$), while the rate of postoperative complications was comparable between both groups (10.7% vs. 14.7%; $p = 0.47$). These findings support the growing evidence that early surgical intervention during the index admission offers substantial clinical and logistical advantages without increasing complication risk. Our results are in agreement with Moosa et al. (2025), who reported a shorter hospital stay in both early and delayed groups (2.47 ± 1.08 vs. 2.45 ± 1.06 days) and a slightly higher bile leak rate in the early group (11.9% vs. 2.4%), indicating comparable safety between both approaches with a trend toward shorter hospitalization in early surgery.[15] Similarly, Budiæcã et al. (2024) found that early laparoscopic cholecystectomy (ELC) was associated with fewer conversions to open surgery and reduced hospitalization duration, further emphasizing its clinical benefits even under challenging healthcare conditions.[16]

Ahmad et al. (2020) also reported significantly lower operative time (79.65 ± 8.33 vs. 99.5 ± 10.78 min; $p = 0.002$), less operative blood loss (52.12 ± 9.99 vs. 81.22 ± 8.63 ml; $p = 0.000$), and shorter hospital stay (3.1 ± 0.3 vs. 8.1 ± 0.8 days; $p = 0.000$) in early laparoscopic cholecystectomy, closely mirroring our

findings.[17] Their study also showed a higher but statistically insignificant bile duct injury rate in delayed cases, reinforcing that early surgery does not compromise safety.

Mehmood et al. (2024) compared 390 cases and demonstrated that early laparoscopic cholecystectomy significantly reduced postoperative complications ($p < 0.04$), hospital stay ($p < 0.003$), and recurrence rates ($p < 0.002$), with comparable mortality rates between groups.[18] These outcomes align with our results, indicating that early intervention prevents recurrent biliary events and reduces the burden of prolonged conservative management. Similarly, Bhurt et al. (2020) found conversion rates of 5.1% in early and 6.1% in delayed groups ($p = 0.711$), showing statistically insignificant differences but favoring early cholecystectomy for overall efficacy and reduced use of antibiotics and analgesics during the waiting period.[19] Ismail et al. (2021) also observed a significantly shorter hospitalization duration (2.8 ± 1.1 vs. 5.3 ± 0.8 days; $p < 0.001$) in the early group, while operative time (43.9 ± 11.1 vs. 45.8 ± 10.1 minutes; $p = 0.83$) and complications (14.1% vs. 5.9%; $p = 0.07$) were comparable.[20] This further supports that early laparoscopic cholecystectomy is safe and efficient, with similar intraoperative risk. Overall, the present study adds to the growing consensus that early laparoscopic cholecystectomy is not only safe but also associated with decreased hospital stay, faster recovery, and comparable complication rates compared to delayed surgery. These results strongly support performing laparoscopic cholecystectomy during the same hospital admission for acute cholecystitis, thereby reducing healthcare costs and patient morbidity.

This study included a well-defined sample of 150 patients, allowing direct comparison between early and delayed laparoscopic cholecystectomy groups. Standardized surgical techniques and consistent perioperative protocols minimized procedural bias. Outcomes were objectively assessed using operative time, complications, and hospital stay. However, it was a single-center study with limited sample size and non-randomized design. Surgeon experience variations and exclusion of severe cholecystitis cases may affect generalizability. Longer follow-up could further validate the long-term outcomes.

CONCLUSION

Early laparoscopic cholecystectomy was associated with shorter operative time, reduced postoperative pain, and significantly shorter hospital stay compared to delayed surgery. Both approaches were comparable in complication rates, supporting early intervention as a safe and efficient treatment option for acute cholecystitis.

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