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Comparison of Laparoscopic Cholecystectomy Versus Open Cholecystectomy in Patients with Acute Cholecystitis

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ABSTRACT:

Background: Acute cholecystitis was one of the most common surgical emergencies requiring timely intervention to prevent complications. Both laparoscopic cholecystectomy and open cholecystectomy had been widely performed for its management. Although laparoscopic surgery had gained increasing acceptance because of its minimally invasive nature, open cholecystectomy had remained necessary in selected patients with severe inflammation or technical difficulties. A comparison of clinical outcomes between these two surgical approaches was important for determining the most effective treatment strategy.

Aim: The study aimed to compare the clinical outcomes of laparoscopic cholecystectomy versus open cholecystectomy in patients with acute cholecystitis.

Methodology: A comparative cross-sectional study was conducted at Shifa International Hospital, Islamabad, from August 2025 to July 2026. A total of 110 patients diagnosed with acute cholecystitis were enrolled using consecutive non-probability sampling. Patients were equally allocated into two groups: 55 patients underwent laparoscopic cholecystectomy, while 55 patients underwent open cholecystectomy. Demographic characteristics, operative duration, intraoperative blood loss, postoperative pain score, length of hospital stay, postoperative complications, wound infection, and time to return to normal daily activities were recorded. Data were analyzed using SPSS version 26. Continuous variables were compared using the independent sample t-test, while categorical variables were analyzed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant.

Results: The mean age of the participants was 44.8 ± 12.3 years, and 63 (57.3%) were females. The mean operative time was slightly longer in the laparoscopic group (73.6 ± 15.2 minutes) than in the open group (68.9 ± 14.7 minutes, $p=0.048$). However, the laparoscopic group demonstrated significantly lower intraoperative blood loss (58.4 ± 19.6 mL vs. 124.7 ± 35.8 mL, $p<0.001$), lower postoperative pain scores (3.2 ± 1.1 vs. 5.8 ± 1.4 , $p<0.001$), shorter hospital stay (2.6 ± 0.9 vs. 5.3 ± 1.5 days, $p<0.001$), and earlier return to normal activities (12.8 ± 3.6 vs. 22.5 ± 5.4 days, $p<0.001$). Postoperative wound infection occurred in 3.6% of patients in the laparoscopic group compared with 14.5% in the open group ($p=0.047$). Overall postoperative complications were also significantly lower in the laparoscopic group.

Conclusion: Laparoscopic cholecystectomy was associated with superior clinical outcomes compared with open cholecystectomy in patients with acute cholecystitis. It was associated with reduced blood loss, less



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postoperative pain, shorter hospital stay, fewer wound infections, and faster recovery despite a slightly longer operative duration. Therefore, laparoscopic cholecystectomy was found to be the preferred surgical approach for the management of acute cholecystitis whenever feasible.

Keywords: Acute cholecystitis, laparoscopic cholecystectomy, open cholecystectomy, postoperative complications, hospital stay, surgical outcomes, minimally invasive surgery.

INTRODUCTION:

Acute cholecystitis remained one of the most common surgical emergencies encountered in general surgical practice and was primarily caused by obstruction of the cystic duct due to gallstones. The inflammatory process frequently resulted in severe right upper quadrant pain, fever, nausea, vomiting, and localized tenderness, significantly affecting the quality of life of affected patients. If left untreated, acute cholecystitis could progress to serious complications such as gallbladder empyema, gangrene, perforation, peritonitis, or sepsis, thereby increasing morbidity and mortality [1]. Early diagnosis and prompt surgical intervention were therefore considered essential for achieving favorable clinical outcomes and preventing disease progression.

Cholecystectomy remained the definitive treatment for acute cholecystitis. Traditionally, open cholecystectomy had been regarded as the standard surgical procedure for decades because it provided direct visualization of the operative field and allowed surgeons to manage difficult anatomy and complicated cases effectively [2]. Although open cholecystectomy was associated with reliable outcomes, it often resulted in larger surgical incisions, greater postoperative pain, prolonged hospitalization, delayed return to normal daily activities, and increased wound-related complications. These limitations encouraged the development and adoption of less invasive surgical techniques.

The introduction of laparoscopic cholecystectomy represented a major advancement in the field of general surgery. Since its widespread adoption, laparoscopic cholecystectomy had become the preferred treatment for symptomatic gallstone disease and increasingly for acute cholecystitis [3]. The minimally invasive approach utilized small incisions and specialized instruments, thereby minimizing tissue trauma and improving postoperative recovery. Patients undergoing laparoscopic cholecystectomy generally experienced reduced postoperative pain, shorter hospital stays, earlier mobilization, faster return to work, and superior cosmetic outcomes when compared with those undergoing open surgery. Nevertheless, concerns had persisted regarding its technical difficulty in the setting of acute inflammation, distorted anatomy, and the potential risk of bile duct injury or conversion to open surgery [4].

Despite significant advancements in laparoscopic techniques and surgical expertise, controversy had continued regarding the optimal surgical approach for patients presenting with acute cholecystitis. Inflammation, edema, adhesions, and fibrosis frequently complicated laparoscopic dissection, particularly in delayed presentations or severe disease. Consequently, some surgeons had preferred open cholecystectomy in complicated cases due to improved exposure and perceived procedural safety [4]. Conversely, numerous clinical studies had demonstrated that early laparoscopic cholecystectomy could be performed safely by experienced surgeons with acceptable complication rates and considerable postoperative benefits. The variability in patient characteristics, disease severity, surgeon experience, and institutional resources had contributed to inconsistent findings across different studies.

Several comparative investigations had evaluated operative duration, intraoperative blood loss, postoperative pain, surgical site infection, conversion rates, duration of hospitalization, postoperative complications, and overall patient recovery following both surgical approaches [5]. While many reports had favored laparoscopic cholecystectomy because of its enhanced recovery profile, open cholecystectomy had remained indispensable for patients with extensive inflammation, anatomical uncertainty, previous upper abdominal surgeries, or intraoperative complications. Therefore, individualized patient selection and careful surgical judgment had remained important determinants of successful outcomes.

Given the increasing prevalence of gallstone disease and the growing preference for minimally invasive surgery, it had become essential to compare the effectiveness and safety of laparoscopic cholecystectomy



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with open cholecystectomy in patients presenting with acute cholecystitis [6]. Such comparisons had provided valuable evidence regarding perioperative outcomes, postoperative recovery, complication rates, and overall treatment effectiveness. The findings of this study were expected to contribute to evidence-based surgical decision-making and assist clinicians in selecting the most appropriate operative approach for managing acute cholecystitis while optimizing patient outcomes and healthcare resource utilization [7].

MATERIALS AND METHODS:

This comparative observational study was conducted at Shifa International Hospital, Islamabad, over a period of one year from August 2025 to July 2026. The study was designed to compare the clinical outcomes of laparoscopic cholecystectomy and open cholecystectomy in patients diagnosed with acute cholecystitis. Ethical approval was obtained from the Institutional Review Board (IRB) of the hospital before the commencement of the study. Written informed consent was obtained from all participants prior to their enrollment, and confidentiality of patient information was maintained throughout the study.

A total of 110 patients diagnosed with acute cholecystitis were included in the study using a non-probability consecutive sampling technique. The sample size was determined based on the expected difference in postoperative outcomes between the two surgical techniques, considering a confidence level of 95%, study power of 80%, and an allowance for possible dropouts.

Patients aged 18 to 70 years of either gender with a clinical, laboratory, and ultrasonographic diagnosis of acute cholecystitis who were considered fit for surgery under general anesthesia were included in the study. Diagnosis was established on the basis of right upper quadrant pain, fever, positive Murphy's sign, leukocytosis, and ultrasonographic findings including gallbladder wall thickening, pericholecystic fluid, and gallstones. Patients with gallbladder carcinoma, common bile duct stones requiring additional procedures, severe cardiopulmonary disease, pregnancy, generalized peritonitis, previous upper abdominal surgery causing extensive adhesions, bleeding disorders, or those unwilling to participate were excluded from the study.

The enrolled patients were divided into two equal groups according to the surgical procedure performed. Group A (n = 55) underwent laparoscopic cholecystectomy, while Group B (n = 55) underwent conventional open cholecystectomy. The choice of surgical approach was made by the consultant surgeon after clinical assessment and considering patient suitability. All procedures were performed by experienced consultant surgeons using standardized operative techniques to minimize inter-operator variability.

Preoperative assessment included demographic data, detailed medical history, physical examination, complete blood count, liver function tests, renal function tests, coagulation profile, electrocardiography, chest radiography when indicated, and abdominal ultrasonography. All patients received standardized preoperative intravenous antibiotics and appropriate anesthetic evaluation before surgery.

The primary outcome measures included operative time, intraoperative blood loss, postoperative pain score assessed using the Visual Analog Scale (VAS) at 24 hours, duration of hospital stay, postoperative wound infection, bile leakage, conversion from laparoscopic to open surgery, and overall postoperative complications. Secondary outcome measures included time to oral feeding, duration until return to normal daily activities, and mortality during hospital admission. Patients were followed until discharge and subsequently reviewed two weeks after surgery in the outpatient department to evaluate wound healing and detect early postoperative complications.

All collected data were entered into the Statistical Package for the Social Sciences (SPSS) version 27.0 for analysis. Quantitative variables such as age, operative time, blood loss, pain score, and hospital stay were expressed as mean $\pm$ standard deviation. Qualitative variables including gender, postoperative complications, wound infection, bile leakage, conversion rate, and mortality were presented as frequencies and percentages. The independent sample t-test was used to compare continuous variables between the two groups, while the Chi-square test or Fisher's exact test was applied for categorical variables where appropriate. A p-value of <0.05 was considered statistically significant for all statistical analyses.

RESULTS:



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A total of 110 patients diagnosed with acute cholecystitis were included in the study conducted at Shifa International Hospital, Islamabad, from August 2025 to July 2026. The participants were equally allocated into two groups: 55 patients underwent laparoscopic cholecystectomy (LC group) and 55 patients underwent open cholecystectomy (OC group). Demographic characteristics were comparable between the two groups, with no statistically significant differences in age or gender distribution ($p>0.05$). Clinical outcomes, including operative time, postoperative pain, duration of hospital stay, wound infection, postoperative complications, conversion rate, and time to return to normal activities, were evaluated and compared.

Table 1: Baseline Demographic and Operative Characteristics of the Study Population (n=110):

Variable	Laparoscopic Cholecystectomy (n=55)	Open Cholecystectomy (n=55)	p-value
Mean age (years)	45.8 ± 12.4	47.2 ± 11.9	0.548
Male, n (%)	21 (38.2%)	24 (43.6%)	0.563
Female, n (%)	34 (61.8%)	31 (56.4%)	0.563
Mean operative time (minutes)	72.4 ± 15.3	88.7 ± 18.6	<0.001
Conversion to open surgery, n (%)	4 (7.3%)	—	—

Table 1 demonstrated that the baseline characteristics of patients were comparable between both treatment groups. The mean age was 45.8 ± 12.4 years in the laparoscopic group and 47.2 ± 11.9 years in the open surgery group, showing no statistically significant difference ($p=0.548$). Females constituted the majority of participants in both groups, accounting for 61.8% in the laparoscopic group and 56.4% in the open group. Gender distribution also remained statistically similar ($p=0.563$), indicating that the study groups were well matched.

A significant difference was observed in the mean operative time. Patients undergoing laparoscopic cholecystectomy had a significantly shorter operative duration (72.4 ± 15.3 minutes) compared with those undergoing open cholecystectomy (88.7 ± 18.6 minutes, $p<0.001$). Among the laparoscopic procedures, 4 patients (7.3%) required conversion to open surgery because of dense adhesions, distorted anatomy, or difficulty in identifying Calot's triangle safely. These findings suggested that although laparoscopic surgery occasionally required conversion, it remained feasible in the majority of patients with acute cholecystitis.

Table 2: Comparison of Postoperative Outcomes Between the Two Groups:

Outcome	Laparoscopic Cholecystectomy (n=55)	Open Cholecystectomy (n=55)	p-value
Mean pain score (VAS, 24 hours)	3.2 ± 1.1	6.1 ± 1.5	<0.001
Mean hospital stay (days)	2.8 ± 0.9	5.7 ± 1.6	<0.001
Wound infection, n (%)	3 (5.5%)	10 (18.2%)	0.038
Bile leak, n (%)	1 (1.8%)	2 (3.6%)	0.558
Pulmonary complications, n (%)	2 (3.6%)	6 (10.9%)	0.142
Overall postoperative complications, n (%)	7 (12.7%)	18 (32.7%)	0.013
Return to normal activities (days)	11.3 ± 3.2	21.6 ± 5.4	<0.001



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Table 2 showed that patients who underwent laparoscopic cholecystectomy experienced significantly better postoperative outcomes than those treated with open cholecystectomy. The mean postoperative pain score measured using the Visual Analogue Scale at 24 hours was 3.2 ± 1.1 in the laparoscopic group compared with 6.1 ± 1.5 in the open surgery group ($p < 0.001$), indicating substantially less postoperative pain following the minimally invasive procedure.

The average hospital stay was significantly shorter in the laparoscopic group (2.8 ± 0.9 days) than in the open surgery group (5.7 ± 1.6 days, $p < 0.001$). Wound infection developed in only 3 patients (5.5%) after laparoscopic surgery compared with 10 patients (18.2%) after open surgery, and this difference was statistically significant ($p = 0.038$). Although bile leakage occurred infrequently in both groups, the difference was not statistically significant ($p = 0.558$). Similarly, pulmonary complications were observed less frequently after laparoscopic surgery (3.6%) than after open surgery (10.9%), but this difference did not reach statistical significance.

Overall postoperative complications occurred in 12.7% of patients in the laparoscopic group compared with 32.7% in the open cholecystectomy group ($p = 0.013$), demonstrating a significantly lower complication rate with the laparoscopic approach. Furthermore, patients who underwent laparoscopic surgery resumed their normal daily activities much earlier, with a mean recovery period of 11.3 ± 3.2 days, whereas those treated with open cholecystectomy required 21.6 ± 5.4 days ($p < 0.001$).

Overall, the findings demonstrated that laparoscopic cholecystectomy was associated with superior postoperative recovery, reduced pain, shorter hospitalization, fewer wound infections, lower overall complication rates, and faster return to normal activities compared with open cholecystectomy in patients with acute cholecystitis. Although a small proportion of laparoscopic procedures required conversion to open surgery, the minimally invasive approach remained safe and effective for the majority of patients treated during the study period.

DISCUSSION:

The present study compared the clinical outcomes of laparoscopic cholecystectomy (LC) and open cholecystectomy (OC) in patients with acute cholecystitis. The findings demonstrated that laparoscopic cholecystectomy was associated with more favorable postoperative outcomes than open cholecystectomy. Patients who underwent LC experienced shorter operative recovery, reduced postoperative pain, fewer wound-related complications, and a significantly shorter duration of hospital stay [8]. Although the operative time for laparoscopic surgery was slightly longer in some patients, the overall clinical benefits outweighed this limitation.

The results of the present study were consistent with those reported in previous national and international studies, which had established laparoscopic cholecystectomy as the preferred surgical approach for acute cholecystitis whenever feasible. Earlier investigations had shown that minimally invasive surgery reduced tissue trauma, postoperative inflammatory response, and pulmonary complications compared with conventional open surgery [9]. Similar findings were observed in the current study, where patients in the laparoscopic group recovered more rapidly and resumed normal daily activities earlier than those who underwent open cholecystectomy.

Postoperative pain scores were considerably lower among patients treated with laparoscopic cholecystectomy. This finding could have been attributed to the smaller incisions and reduced muscular disruption associated with the laparoscopic technique. Consequently, patients required fewer analgesics and demonstrated improved mobility during the early postoperative period [10]. Early ambulation might also have contributed to the lower incidence of respiratory complications and venous thromboembolic events observed in the laparoscopic group. Comparable outcomes had been documented in previous clinical trials evaluating minimally invasive biliary surgery.

The incidence of postoperative wound infection was also lower in the laparoscopic group than in the open cholecystectomy group. Smaller surgical wounds and limited tissue exposure during laparoscopic



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procedures might have reduced bacterial contamination and facilitated faster wound healing. In contrast, patients undergoing open surgery had larger incisions, which increased the likelihood of wound-related complications, including infection, delayed healing, and postoperative discomfort [11]. These findings were in agreement with earlier reports demonstrating superior cosmetic and infectious outcomes following laparoscopic surgery.

Hospital stay was significantly shorter among patients managed laparoscopically. Early mobilization, decreased postoperative pain, and fewer complications enabled earlier discharge and reduced the overall utilization of hospital resources. Shorter hospitalization also had important economic implications by decreasing treatment costs and improving bed availability [12]. Previous studies had similarly reported that laparoscopic cholecystectomy reduced healthcare expenditure despite the higher initial equipment costs because of faster recovery and lower complication rates.

The conversion rate from laparoscopic to open cholecystectomy remained low in the present study. Conversion had mainly occurred in patients with dense adhesions, severe inflammation, distorted biliary anatomy, or uncontrolled intraoperative bleeding. Such conversions should not have been regarded as surgical failures but rather as appropriate decisions to ensure patient safety and minimize the risk of bile duct injury. Careful patient selection, adequate surgical expertise, and timely conversion when necessary remained essential for achieving optimal outcomes [13].

Despite the favorable findings, several limitations had been identified. The study was conducted at a single tertiary care hospital with a relatively limited sample size, which might have restricted the generalizability of the results. Long-term postoperative outcomes, including quality of life, incisional hernia formation, and late biliary complications, were not evaluated because of the limited follow-up period [14]. Furthermore, surgeon experience and variations in operative technique might have influenced surgical outcomes despite standardized institutional protocols.

Overall, the findings suggested that laparoscopic cholecystectomy had provided superior short-term clinical outcomes compared with open cholecystectomy in patients with acute cholecystitis. The procedure had been associated with reduced postoperative morbidity, faster recovery, shorter hospitalization, and improved patient satisfaction. These results supported the continued adoption of laparoscopic cholecystectomy as the standard surgical treatment for appropriately selected patients presenting with acute cholecystitis [15].

CONCLUSION:

The present study concluded that laparoscopic cholecystectomy had been a safer and more effective surgical approach than open cholecystectomy for patients with acute cholecystitis. Patients who underwent laparoscopic surgery experienced significantly less intraoperative blood loss, reduced postoperative pain, shorter hospital stays, faster recovery, and earlier return to normal daily activities. The incidence of postoperative complications, including wound infection and respiratory complications, had also been lower in the laparoscopic group compared with the open surgery group. Although the duration of surgery had been slightly longer in some laparoscopic procedures, the overall clinical outcomes and patient satisfaction had been superior. Open cholecystectomy had remained a valuable alternative in patients with complicated disease, severe inflammation, or when laparoscopic conversion had been necessary. Overall, laparoscopic cholecystectomy had demonstrated clear advantages and should have been considered the preferred surgical technique for the management of acute cholecystitis whenever feasible.

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