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Original Research Article

Comparative Evaluation of Laparoscopic versus Open Cholecystectomy in Acute Cholecystitis: A Prospective Study

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Abstract:

Background: Acute cholecystitis (AC) is a common emergency complication of gallstones, traditionally managed by open cholecystectomy (OC), but laparoscopic cholecystectomy (LC) has emerged as the preferred approach due to minimally invasive advantages.

Aim: To prospectively compare perioperative outcomes, complications, and recovery between LC and OC in patients with AC.

Methodology: A nine-month prospective observational study was conducted at Department of General Surgery, Shree Narayan Medical Institute and Hospital, Saharsa, Bihar, India, including 200 adult patients (LC: 130; OC: 70) diagnosed with AC per Tokyo Guidelines 2018. Data collected included demographics, ASA class, operative parameters, postoperative pain, complications (Clavien–Dindo), and hospital stay. LC was performed via standard four-port technique, with conversion to OC documented. Statistical analysis used t-tests, Chi-square, and Mann–Whitney U tests ($p<0.05$ significant).

Results: LC patients were younger with lower ASA class and disease severity. LC had shorter operative time (72.8 vs. 95.4 min), lower blood loss (70 vs. 200 mL), reduced drain usage (33.8% vs. 74.3%), and faster recovery (earlier oral intake and ambulation; $p<0.001$). Postoperative complications were lower in LC (15.4% vs. 35.7%; $p=0.001$), particularly wound infection. Median hospital stay was shorter for LC (3 vs. 8 days; $p<0.001$). Conversion rate to OC was 10.8%, mainly due to difficult anatomy. Mortality was 0% vs. 1.4% in OC.

Conclusion: LC is safe and superior to OC in AC, offering reduced morbidity, faster recovery, and shorter hospitalization, with open surgery reserved for complex cases.

Keywords: Acute Cholecystitis, Laparoscopic Cholecystectomy, Open Cholecystectomy, Perioperative Outcomes, Prospective Study.

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Introduction

Acute cholecystitis (AC) is a transitory inflammatory disease of the gallbladder that mainly occurs as a result of the blockage of the cystic duct due to gallstones. This obstruction results in progressive distension of the gallbladder, mural ischemia, colonization by bacteria and severe cases will cause systemic inflammatory response [1]. Being one of the most common complications of cholelithiasis, AC is an important contributor of emergency hospitalization and a major contributor of healthcare use and expenditure around the globe. There is an increasing trend in the epidemiological rates of incidence and hospital admission based on acute gallbladder disease due to changing demographics, lifestyle and enhanced diagnostic sensitivity as indicated by epidemiological data on large administrative databases [2].

Traditionally, the acute cholecystitis condition was treated conservatively with the acute condition and delayed elective surgery. Nevertheless, during the last thirty years, the treatment paradigm has changed by the development of perioperative care, anesthesia, antibiotic treatment, and minimal invasive surgeries [3]. Modern practice has greatly moved in support of early definitive surgical intervention during index admission. This change is backed by an increasing amount of evidence that early surgery lowers total hospitalization, avoids recurrence of attacks, as well as causes fewer complications due to late intervention.

Introduction and internationalization of laparoscopic cholecystectomy (LC) have been a significant breakthrough in hepatobiliary surgery. LC is now the new standard of managing symptomatic cholelithiasis and is emerging to be used in acute cholecystitis. The diagnosis criteria and the severity grading of AC further became standardized, with the publication of the Tokyo Guidelines 2018 (TG18) defining three types of clinical presentation, laboratory results, and the appearance on imaging (Grade I (mild), Grade II (moderate), and Grade III (severe)) [4]. This hierarchical system enables clinicians to rank the severity of diseases and manage them respectively. TG18 suggests laparoscopic cholecystectomy at an early stage in the majority of patients with Grade I and Grade II AC and in selected Grade III patients provided they are done in centers with sufficient surgical skills and perioperative care [5].

One of the major developments which have been identified as crucial by TG18 is the idea of safety in laparoscopic surgery. In awareness of the fact that acute inflammation corrupts biliary morphology and heightens the chances of vasculobiliary trauma, TG18 supports the routine use of the critical view of safety method, bail-out techniques like subtotal cholecystectomy in situations where safe dissection is no longer possible. Early conversion to open cholecystectomy (OC) may be also viewed as a relevant and wise move in case of deficiency in the anatomical clarity, which supports the fact that conversion can be a good move towards sound surgical judgment and not a failure [6].

On the same note, the WSES 2020 guidelines support laparoscopic cholecystectomy as the treatment of choice of acute calculous cholecystitis in case of technical possibility. The WSES recommendations focus on early surgical intervention in the same hospital stay, adequate selection of patients, and case-specific approach to high-risk groups. These suggestions highlight the fact that LC is better than open surgery in most situations, given the right kind of expertise.

Although there is a great deal of guideline support of LC, open cholecystectomy remains an important aspect of particular clinical conditions. OC can be chosen as the first choice in patients having advanced inflammation, suspected malignancy of the gallbladder, thick adhesions due to past upper abdomen surgeries, or in those healthcare centers that lack laparoscopic facilities and skills. Moreover, LC to OC conversion is another important safety precaution in challenging cases so as to avoid disastrous complications like bile duct or great vascular damage [7]. There are factors that have been determined as linked with the high conversion risk in predictive models and meta-analyses such as the male gender, older age, late presentation, the high level of inflammatory markers, thickening of the gallbladder wall, and the existence of the pericholecystic fluid collection on the images [8]. The identification of such predictors helps in preoperative planning and counseling the patient.

In terms of clinical outcomes, early laparoscopic cholecystectomy is linked to a number of benefits as opposed to open surgery. There have been chances of less postoperative pain, less time in the hospital, fewer cases of wound infection, faster recovery to normal activities, and cosmetic satisfaction [9]. Minimal invasive surgery also reduces pulmonary complications and postoperative ileus which is more applicable in elderly or comorbid patients. Nevertheless, issues about the operative difficulty in the environment of severe inflammation, the potentially extended operative time, and the risk of the bile duct injury remain in place, particularly with reference to an advanced or a delayed manifestation of AC [10].

The most recent data points to the fact that in the case of advanced laparoscopic skills, better equipment, and correct adherence to the principles of safe dissection, the early LC can be conducted with a high level of safety even in the patients who are outside of the traditionally accepted range of time [11] in the selected cases. The adoption of bail-out operations, including subtotal cholecystectomy and readiness to convert when required have also led to better safety profiles. Moreover, the experience of the institutional setting and the experience of the surgeon play a significant role, which indicates the importance of the context-specific analysis.

Although evidence supporting the use of laparoscopic management has cumulated, there remains inconsistency in the real-life application of this practice. Institutional procedures, experience of the surgeon, demographics of the patient, and availability of resources can be discrepant factors that could affect the decision between laparoscopy and open procedures. In addition, the high level of evidence is ensured by randomized trials and meta-analyses; however, prospective observational studies directly held in a particular hospital setting are necessary to estimate local results, complication rates, and practicability.

In these respects, the current prospective research is sought to comparatively analyze laparoscopic and open cholecystectomy in patients with acute cholecystitis. The perioperative parameters, such as length of operation, intraoperative results, necessity of conversion, postoperative pain, and complications and the length of stay in the hospital are the subjects of the study. Through a systematic review of morbidity and recovery rates in the two surgery methods, this research study aims to present institution-specific evidence capable of streamlining the practice of surgical decision-making, improving patient safety, and enhancing clinical practice by

aligning the clinical practice to the current guideline recommendations.

Methodology

Study Design: This study was conducted as a prospective comparative observational study aimed at evaluating and comparing the clinical outcomes of laparoscopic cholecystectomy (LC) and open cholecystectomy (OC) in patients diagnosed with acute calculous cholecystitis. Patients were followed from admission through the postoperative period to assess intraoperative findings, postoperative recovery, and complications.

Study Area: The study was carried out in the Department of General Surgery, Shree Narayan Medical Institute and Hospital, Saharsa, Bihar, India.

Study Duration: The study was conducted over a period of nine months.

Sample Size: A total of 200 patients were included in the study. Among them, 130 patients underwent laparoscopic cholecystectomy (LC), while 70 patients underwent open cholecystectomy (OC). The allocation of surgical approach was based on clinical severity, anesthetic fitness, imaging findings, and intraoperative judgment of the operating surgeon.

Study Population: The study population comprised adult patients presenting with signs and symptoms suggestive of acute calculous cholecystitis. Diagnosis was established based on clinical findings such as right upper quadrant pain and tenderness with or without fever, laboratory evidence of inflammation including elevated white blood cell count and C-reactive protein levels, and ultrasonographic findings demonstrating gallstones with gallbladder wall thickening and/or pericholecystic fluid. Diagnosis and severity grading (Grade I, II, or III) were determined according to the Tokyo Guidelines 2018 (TG18). Patients underwent either LC or OC depending on disease severity, American Society of Anesthesiologists (ASA) classification, imaging complexity, and surgeon discretion. Cases requiring conversion from LC to OC were documented and analyzed accordingly.

Inclusion Criteria

- Age ≥18 years.
- Diagnosis of acute calculous cholecystitis as per TG18 criteria.
- Symptom onset ≤10 days.
- Patients fit for surgery during index admission (including stabilized high-risk patients).

Exclusion Criteria

- Acalculous cholecystitis.
- Concomitant cholangitis requiring urgent ERCP prior to surgery (unless stabilized).
- Suspected gallbladder malignancy.
- Pregnancy.
- Uncorrectable coagulopathy.
- Severe cardiopulmonary instability prohibiting general anesthesia.
- Refusal to provide informed consent.

Data Collection

Data were collected prospectively using a structured case record proforma. Preoperative data included demographic details, comorbidities, duration of symptoms, laboratory parameters, ultrasonographic findings, severity grading, and ASA classification. Intraoperative variables recorded were operative time, estimated blood loss, drain placement, intraoperative complications, and need for conversion from LC to OC. Postoperative data included pain assessment using the Visual Analog Scale (VAS) at 24 and 48 hours, time to oral intake, length of hospital stay, and postoperative complications such as wound infection, bile leak, intra-abdominal collection, bile duct injury, and readmission within 30 days. Complications were graded according to the Clavien–Dindo classification.

Procedure: All patients underwent detailed clinical evaluation and preoperative assessment. After obtaining written informed consent, patients were operated under general anesthesia. Laparoscopic cholecystectomy was performed using the standard four-port technique with creation of pneumoperitoneum and dissection of Calot's triangle to achieve the critical view of safety before clipping and dividing the cystic duct and artery. Open cholecystectomy was performed through a right subcostal (Kocher's) incision, with identification and ligation of the cystic duct and artery followed by removal of the gallbladder. Postoperative management was standardized in both groups, including administration of antibiotics, analgesics, early mobilization, and monitoring for complications.

Outcome Measures: The primary outcomes assessed were overall postoperative complications, graded according to the Clavien–Dindo classification, and length of postoperative hospital stay. Secondary outcomes included operative time, intraoperative blood loss, drain usage, postoperative pain scores at 24 and 48 hours, wound complications, bile leak, intra-abdominal collection, bile duct injury, and 30-day readmission rate.

Statistical Analysis: All collected data were entered into Microsoft Excel and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation and compared between groups using the Student's t-test for normally distributed data or the Mann–Whitney U test for non-normally distributed data. Categorical

variables were expressed as frequencies and percentages and compared using the Chi-square test or Fisher's exact test where appropriate. A p-value of less than 0.05 was considered statistically significant.

Result

Table 1 summarizes the baseline demographic and clinical characteristics of patients undergoing laparoscopic cholecystectomy (LC, n = 130) versus open cholecystectomy (OC, n = 70). Patients in the LC group were younger, with a mean age of 45.2 ± 11.8 years compared to 52.6 ± 13.9 years in the OC group (p = 0.001). The proportion of males was slightly lower in the LC group (38.5% vs 51.4%, p = 0.08), and BMI was comparable between groups (25.9 ± 3.8 vs 26.7 ± 4.0 kg/m², p = 0.19). Diabetes was present in 24.6% of LC patients and 37.1% of OC patients (p = 0.07). Higher ASA class (III–IV) was significantly more frequent in the OC group (40.0% vs 16.9%, p < 0.001), as was symptom duration >72 hours (60.0% vs 36.9%, p = 0.002) and TG18 Grade II–III severity (68.6% vs 38.5%, p < 0.001). Overall, patients undergoing open cholecystectomy had higher comorbidity and disease severity at baseline.

Table 1: Baseline demographic and clinical characteristics

Variable	LC (n=130)	OC (n=70)	p-value
Age (years), mean ± SD	45.2 ± 11.8	52.6 ± 13.9	0.001*
Male sex, n (%)	50 (38.5)	36 (51.4)	0.08
BMI (kg/m²), mean ± SD	25.9 ± 3.8	26.7 ± 4.0	0.19
Diabetes mellitus, n (%)	32 (24.6)	26 (37.1)	0.07
ASA III–IV, n (%)	22 (16.9)	28 (40.0)	<0.001*
Symptom duration >72 h, n (%)	48 (36.9)	42 (60.0)	0.002*
TG18 Grade II–III, n (%)	50 (38.5)	48 (68.6)	<0.001*

Table 2 demonstrates that the LC group had significantly shorter operative time (72.8 ± 20.6 minutes) compared to the OC group (95.4 ± 25.1 minutes) (p < 0.001). Estimated blood loss was also significantly lower in the LC group, with a median of 70 mL (IQR 40–130) versus 200 mL (IQR 130–320) in the OC group (p < 0.001). Drain placement was required less frequently in LC patients (33.8%) than in OC patients (74.3%) (p < 0.001). Dense adhesions were observed more commonly in the OC group (57.1%) compared to the LC group (30.8%) (p = 0.001). However, the rate of subtotal cholecystectomy (bail-out procedure) was comparable between the two groups (9.2% vs 11.4%, p = 0.62). Overall, laparoscopic cholecystectomy was associated with more favorable intraoperative parameters.

Table 2: Operative findings and intraoperative parameters

Parameter	LC (n=130)	OC (n=70)	p-value
Operative time (min), mean ± SD	72.8 ± 20.6	95.4 ± 25.1	<0.001*
Estimated blood loss (mL), median (IQR)	70 (40–130)	200 (130–320)	<0.001*
Drain placed, n (%)	44 (33.8)	52 (74.3)	<0.001*
Dense adhesions, n (%)	40 (30.8)	40 (57.1)	0.001*
Subtotal cholecystectomy (bail-out), n (%)	12 (9.2)	8 (11.4)	0.62

Table 3 shows that out of 130 patients in the LC group, 14 cases (10.8%) required conversion to open cholecystectomy. The most common reason for conversion was unclear Calot's anatomy, accounting for 7 cases (50.0%), followed by uncontrolled bleeding in 3 cases (21.4%) and dense adhesions or frozen Calot's in 3 cases (21.4%). Suspected bile duct injury was the least common reason, occurring in 1 case (7.2%). Overall, difficult anatomy was the leading cause of conversion.

Table 3: Conversion and reasons (LC group only)

Conversion outcome	Value
LC converted to OC, n (%)	14/130 (10.8%)
Reasons for conversion (n, %)	
– Unclear Calot's anatomy	7 (50.0)
– Uncontrolled bleeding	3 (21.4)
– Dense adhesions/frozen Calot's	3 (21.4)
– Suspected bile duct injury	1 (7.2)

Table 4 shows that postoperative complications were significantly lower in the LC group compared to the OC group, with overall complications occurring in 15.4% versus 35.7% of patients, respectively (p = 0.001). Wound infection was significantly more common in the OC group (17.1%) than in the LC group (3.8%) (p = 0.002). Although bile leak, intra-abdominal collection, pneumonia/atelectasis, bile duct injury, and major complications (Clavien–Dindo ≥III) were more frequent in the OC group, these differences were not statistically significant (p > 0.05). Overall, laparoscopic cholecystectomy was associated with fewer postoperative complications compared to open cholecystectomy.

Table 4: Postoperative complications (Clavien–Dindo)

Complication	LC (n=130)	OC (n=70)	p-value
Any complication, n (%)	20 (15.4)	25 (35.7)	0.001*
Wound infection, n (%)	5 (3.8)	12 (17.1)	0.002*
Bile leak, n (%)	3 (2.3)	3 (4.3)	0.44
Intra-abdominal collection, n (%)	3 (2.3)	4 (5.7)	0.21
Pneumonia/atelectasis, n (%)	3 (2.3)	5 (7.1)	0.11
Bile duct injury, n (%)	0 (0)	1 (1.4)	0.18
Clavien–Dindo ≥III, n (%)	5 (3.8)	7 (10.0)	0.09

Table 5 compares pain scores and recovery indicators between the LC group (n = 130) and the OC group (n = 70). Mean VAS pain scores at 24 hours were significantly lower in the LC group (3.4 ± 1.1) compared to the OC group (5.9 ± 1.5) (p < 0.001). Similarly, at 48 hours, LC patients reported less pain (2.3 ± 0.9) than OC patients (4.5 ± 1.2) (p < 0.001). Recovery milestones were also achieved earlier in the LC group, with a shorter time to oral feeds (12 hours, IQR 8–16) versus 26 hours, IQR 18–38 in the OC group, and earlier ambulation (9 hours, IQR 6–14) compared to 22 hours, IQR 16–32 (p < 0.001 for both). Overall, laparoscopic cholecystectomy was associated with significantly less postoperative pain and faster recovery.

Table 5: Pain scores and recovery indicators

Outcome	LC (n=130)	OC (n=70)	p-value
VAS pain at 24 h (0–10), mean ± SD	3.4 ± 1.1	5.9 ± 1.5	<0.001*
VAS pain at 48 h (0–10), mean ± SD	2.3 ± 0.9	4.5 ± 1.2	<0.001*
Time to oral feeds (hours), median (IQR)	12 (8–16)	26 (18–38)	<0.001*
Time to ambulation (hours), median (IQR)	9 (6–14)	22 (16–32)	<0.001*

Table 6 compares hospital stay, readmission, and overall outcomes between the LC group (n = 130) and the OC group (n = 70). The median postoperative stay was significantly shorter in the LC group at 2 days (IQR 2–3) compared to 6 days (IQR 4–8) in the OC group (p < 0.001). Similarly, the total hospital stay was shorter in LC patients (3 days, IQR 2–4) versus OC patients (8 days, IQR 6–10) (p < 0.001). 30-day readmission occurred in 4 patients (3.1%) in the LC group and 6 patients (8.6%) in the OC group, though this difference was not statistically significant (p = 0.1). Mortality was 0% in the LC group and 1 case (1.4%) in the OC group (p = 0.16). Overall, laparoscopic cholecystectomy (LC) was associated with significantly shorter hospital stay, with comparable readmission and mortality rates.

Table 6: Hospital stay, readmission, and overall outcome

Outcome	LC (n=130)	OC (n=70)	p-value
Postoperative stay (days), median (IQR)	2 (2–3)	6 (4–8)	<0.001*
Total hospital stay (days), median (IQR)	3 (2–4)	8 (6–10)	<0.001*
30-day readmission, n (%)	4 (3.1)	6 (8.6)	0.1
Mortality, n (%)	0 (0)	1 (1.4)	0.16

Discussion

The current prospective survey proves that laparoscopic cholecystectomy (LC) has better perioperative and postoperative results than open cholecystectomy (OC) among patients with acute cholecystitis. We used 200 patients in our group, of which LC (65%) is the most common worldwide as the trend towards the minimum invasive approach. The modern guidelines, such as the World Society of Emergency Surgery recommendations and the Tokyo Guidelines 2018, support the use of LC in the majority of patients, assuming that the safety principles are adhered to (Pisano et al., 2020; Yokoe et al., 2018; Okamoto et al., 2018) [3-5]."

In our study, the OC group had more elderly patients (52.6 ± 13.9 vs. 45.2 ± 11.8 years; p=0.001), a higher percentage of ASA III40.0% vs. 16.9% vs. 38.5%; p=0.001) and more patients with TG18 Grade II38.5% vs. 68.6%; p=0.001). This trend correlates with previous observational studies that showed more advanced age, a greater burden of comorbidities, and worse inflammation were the predictors of OC selection or conversion (Hu et al., 2017; San Lio et al., 2022) [7,12]. The authors conclude that older age and male gender were significant predictors of conversion (Hu et al., 2017) [7], and severe cholecystitis and dense adhesions were also found to be significant predictors (Beksac et al., 2016) [8]. Likewise, the incidence of dense adhesions was also stronger in our OC group (57.1% vs. 30.8%; p=0.001), which supports the correlation between a complex inflammatory-based progression and a challenging surgical operation.

Our series had found LC to have a much shorter OR time (72.8 ± 20.6 minutes) than OC (95.4 ± 25.1 minutes; p<0.001). Though previous studies in some cases also recorded longer LC times during learning curve period, more recent results report long and sometimes shorter time with experienced teams (Mou et al., 2019; Wu et al., 2023) [13,14] . In a systematic review, Wu et al. (2023) [14] did not conclude that the early application of LC can meaningfully extend operative time, even in inflamed gallbladders. Meanwhile, the fact that we found significantly less estimated blood loss in LC (median 70 mL vs. 200 mL; p<0.001) is consistent with the finding of large reviews that demonstrated a decrease in intraoperative bleeding and tissue trauma with minimally invasive procedures (Pisano et al., 2020) [3].

Our LC group conversion rate was 10.8% with an unclear Calot anatomy constituting half of the conversions. This is quite similar to pooled conversion rates of 8-15% in literature on acute cholecystitis (Hu et al., 2017; San Lio et al., 2022) [7,12]. Notably, Tokyo Guidelines 2018 point out that conversion ought to be considered as a safety strategy, but not a failure, especially when the critical view of safety is not possible (Wakabayashi et al., 2018) [6]. Similar subtotal cholecystectomy rates of LC and OC (9.2% vs. 11.4%; p=0.62) also indicate compliance with bail-out approaches. The beneficial effect of subtotal cholecystectomy in preventing bile duct injury risk in challenging gallbladders has been evidenced by systematic reviews by Toro et al. (2021) [15], which proves the positive role of this technique in severe inflammation.

Morbidity after surgery was also significantly less than in LC (15.4) compared to OC (35.7; p=0.001). It is noteworthy that the OC group had a significantly higher wound infection rate (17.1% vs. 3.8%; p=0.002), which agrees with the previous findings that larger incisions and more tissue exposure are predisposing factors to surgical site infection (Pisano et al., 2020; Mou et al., 2019) [3,13]. Although the rates of bile leak (2.3% vs. 4.3%) and bile duct injury (0% vs. 1.4) were similar and low in both groups, this result is consistent with the current literature stating that when LC is performed in line with the principles of safety, the rate of bile duct injury is not higher in comparison with OC (Wakabayashi et al., 2018) [6]. The significant difference between the major complication rates in OC (10.0% vs. 3.8%) can be probably attributed to the higher severity of the baseline in this group, which is also characterized in guideline-based stratified analyses (Okamoto et al., 2018) [5].

In our study, pain scores were much lower in the LC group both at 24 and 48 hours (p<0.001) and LC patients returned to oral intake (median 12 vs. 26 hours) and ambulation (median 9 vs. 22 hours) much earlier. These results are in line with randomized and observational studies that positively found superior functional recovery with LC (Janjic et al., 2020; Wu et al., 2023) [9,14]. Similar to our improved recovery results, Janjic et al. (2020) [9] also found much shorter recovery times and earlier discharge with early LC than delayed or open ones.

The duration of stay in the hospital was significantly reduced following LC in our group (median postoperative stay 2 vs. 6 days; total stay 3 vs. 8 days; p<0.001). This decrement of about 35 days is a clinically significant difference and in accordance with the meta-analyses showing fewer hospitalizations and reduced total resources use with LC (Pisano et al., 2020; Wu et al., 2023) [3,14]. The same authors Barka et al. (2023) [10] and van Maasakkers et al. (2024) [11] demonstrated that when there is the expertise, flexibility in timing strategies is not associated with prolongation of hospitalization or high-level morbidity in the case of early LC extension, which should be extended beyond the traditional 7-day window.

Other methods that have been considered in high-risk groups include alternative techniques that involve percutaneous cholecystostomy. In the study by Loozen et al. (2018) [16], the CHOCOLATE randomized trial showed that there were more major complication and reintervention rates with drainage than laparoscopic cholecystectomy among suitable candidates. Follow-up meta-analyses (Huang et al., 2022; Nassar et al., 2022) [17,18] confirmed the long-term results of definitive surgery are better than drainage. Though we did not make a comparison directly on drainage, the positive results of the LC including those of the chosen moderate-to-severe cases argue in support of the emerging idea that definitive surgery should be done early in case that is possible.

We had low mortality rates in our series (0.0 in LC vs. 1.4 in OC; p=0.16), which is similar to modern mortality rates at less than 2 percent in the majority of the current series (Koti et al., 2019) [19]. The safety of the minimally invasive approach is indicated by the fact that mortality did not occur in LC when the patients were properly selected.

Overall, our findings closely parallel current high-quality evidence and international recommendations. LC demonstrated lower morbidity (15.4% vs. 35.7%), reduced wound infection (3.8% vs. 17.1%), shorter operative time, less blood loss, faster recovery, and significantly reduced hospital stay compared with OC. While OC remains indispensable for advanced disease and as a conversion strategy in unsafe anatomy, the accumulated evidence—including our prospective data—reinforces LC as the standard of care for most patients with acute cholecystitis when performed within a structured safety framework.

Conclusion

This prospective comparative study demonstrates that laparoscopic cholecystectomy is a safe and effective approach for the management of acute cholecystitis, offering significant advantages over open cholecystectomy in terms of shorter operative time, reduced blood loss, lower need for drain placement, decreased postoperative pain, earlier return to oral intake and ambulation, and shorter hospital stay. Although the open group comprised patients with relatively higher clinical severity and comorbidity burden, laparoscopic surgery was associated with fewer overall postoperative complications, particularly wound infections, without an increased risk of major complications, bile duct injury, readmission, or mortality. The observed conversion rate was acceptable and primarily related to difficult anatomy and dense adhesions. Overall, laparoscopic cholecystectomy should be considered the preferred surgical modality in acute cholecystitis, with open surgery reserved for selected high-risk or complex cases.

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