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Original Article

Comparison of Postoperative Outcome in Laparoscopic Versus Open Cholecystectomy in Diabetic Patients

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ABSTRACT

Background: Diabetes mellitus is associated with an increased risk of gallstone disease and postoperative complications because of impaired immunity and delayed wound healing. Laparoscopic cholecystectomy has become the preferred treatment for symptomatic cholelithiasis; however, its benefits in diabetic patients require further evaluation. The present study compared postoperative outcomes between laparoscopic and open cholecystectomy in diabetic patients.

Methods: This prospective comparative observational study was conducted in the Department of General Surgery, Era's Lucknow Medical College and Hospital, Lucknow, over 18 months. A total of 102 diabetic patients with symptomatic cholelithiasis were enrolled and divided into two groups: laparoscopic cholecystectomy (n=51) and open cholecystectomy (n=51). Operative characteristics, postoperative pain, blood loss, hospital stay, complications, and recovery outcomes were compared using appropriate statistical tests, with a p-value <0.05 considered statistically significant.

Results: The mean age of the participants was 46.17 ± 17.05 years, with females constituting 62.7% of the study population. Laparoscopic cholecystectomy had a significantly longer operative time (72 ± 14 vs. 60 ± 18 minutes; p<0.001) but resulted in significantly lower blood loss (40 ± 15 vs. 90 ± 30 mL; p<0.001), reduced postoperative pain at 6, 24, and 48 hours (p<0.001), shorter hospital stay (2.92 ± 0.85 vs. 6.18 ± 1.41 days; p<0.001), earlier return to normal activities, and lower drain requirement. Postoperative complications, including surgical site infection and ileus, were less frequent in the laparoscopic group, while intraoperative complication rates were comparable between groups.

Conclusion: Laparoscopic cholecystectomy provides superior postoperative outcomes compared with open cholecystectomy in diabetic patients by reducing postoperative pain, blood loss, hospital stay, and recovery time, despite a longer operative duration. It should be considered the preferred surgical approach for eligible diabetic patients with symptomatic gallstone disease.

Keywords*: Diabetes mellitus; Cholelithiasis; Laparoscopic cholecystectomy; Open cholecystectomy; Postoperative outcomes; Gallstone disease.*

INTRODUCTION

Gallstone disease is one of the most common gastrointestinal disorders requiring surgical intervention worldwide, affecting approximately 10–20% of the adult population. Patients with diabetes mellitus are at a significantly higher risk of developing gallstones because of altered lipid metabolism, autonomic neuropathy, impaired gallbladder motility, and obesity. Diabetes also increases the risk of postoperative infections, delayed wound healing, and other surgical complications, making appropriate surgical management particularly important in this population (1,2).

Cholecystectomy remains the definitive treatment for symptomatic cholelithiasis. Since its introduction in the late 1980s, laparoscopic cholecystectomy (LC) has become the gold standard owing to its minimally invasive nature, reduced postoperative pain, shorter hospital stay, earlier return to normal activities, and improved cosmetic outcomes (3). Nevertheless, open cholecystectomy (OC) continues to play an important role in complicated gallbladder disease, difficult anatomy, dense adhesions, and situations where laparoscopic surgery is contraindicated or conversion becomes necessary (4).

Patients with diabetes present unique perioperative challenges because chronic hyperglycemia impairs immune function, collagen synthesis, and tissue repair, increasing susceptibility to surgical site infections and prolonged recovery (5). Careful perioperative glycemic control has been shown to improve surgical outcomes and reduce postoperative morbidity. Despite advances in minimally invasive surgery, concerns remain regarding the safety and efficacy of laparoscopic cholecystectomy in diabetic patients due to technical difficulties associated with chronic inflammation and fibrosis (6).

Several studies have compared laparoscopic and open cholecystectomy in the general population and consistently demonstrated favourable outcomes with laparoscopic surgery. However, relatively limited data specifically address postoperative outcomes among diabetic patients, particularly in the Indian population (7,8). Evaluating operative characteristics, postoperative complications, recovery, and glycemic outcomes is therefore essential for optimising surgical management in this high-risk group.

The present prospective comparative observational study was undertaken to compare postoperative outcomes between laparoscopic and open cholecystectomy in diabetic patients with symptomatic cholelithiasis, focusing on operative parameters, postoperative pain, complications, duration of hospital stay, and recovery.

MATERIALS AND METHODS

Study Design and Setting

This prospective comparative observational study was conducted in the Department of General Surgery at Era's Lucknow Medical College and Hospital, Lucknow, Uttar Pradesh, India. The study aimed to compare postoperative outcomes between laparoscopic cholecystectomy (LC) and open cholecystectomy (OC) in diabetic patients undergoing elective surgery for symptomatic cholelithiasis. All patients were managed according to the institutional protocols for perioperative diabetic care.

Study Duration

The study was carried out over a period of 18 months, including patient recruitment, surgical intervention, postoperative follow-up, data collection, and statistical analysis.

Study Population and Sample Size

A total of 102 diabetic patients diagnosed with symptomatic gallstone disease and scheduled for elective cholecystectomy were included in the study.

The patients were divided into two groups:

- Group A: Laparoscopic Cholecystectomy (n = 51)
- Group B: Open Cholecystectomy (n = 51)

Patients were enrolled using a non-probability consecutive sampling technique.

Inclusion Criteria

Patients fulfilling the following criteria were included:

- Diagnosed cases of Type 1 or Type 2 Diabetes Mellitus.
- Age between 18 and 75 years.
- Ultrasonographically confirmed symptomatic cholelithiasis requiring elective cholecystectomy.
- Patients fit for surgery under general anaesthesia (ASA Grade I–III).
- Patients willing to provide written informed consent.

Exclusion Criteria

Patients with any of the following conditions were excluded:

- Acute gallbladder perforation or gangrenous cholecystitis requiring emergency surgery.
- Uncontrolled diabetes mellitus (HbA1c >10%).
- Common bile duct stones requiring ERCP.
- Suspected or confirmed gallbladder malignancy.
- Severe cardiopulmonary disease (ASA Grade IV or above).
- Coagulation disorders or patients receiving anticoagulant therapy that could not be safely discontinued.

- Patients unwilling to participate in the study.

Ethical Considerations
The study protocol was approved by the Institutional Ethics Committee of Era's Lucknow Medical College and Hospital before commencement. Written informed consent was obtained from all participants after explaining the objectives, benefits, and possible risks of the study. Confidentiality of patient information was maintained throughout the study in accordance with the Declaration of Helsinki.

Preoperative Evaluation
All enrolled patients underwent detailed clinical evaluation including demographic characteristics, duration of diabetes mellitus, presenting symptoms, history of previous abdominal surgery, associated comorbidities, and current antidiabetic medications.

Routine laboratory investigations included:
- Complete blood count
- Fasting and postprandial blood glucose
- Glycated hemoglobin (HbA1c)
- Liver function tests
- Renal function tests
- Serum electrolytes
- Coagulation profile
- Urine routine examination

Abdominal ultrasonography was performed in all patients to confirm gallstone disease and evaluate gallbladder wall thickness, number of calculi, common bile duct diameter, and associated biliary pathology.

Preoperative glycemic optimization was achieved using insulin therapy or modification of oral hypoglycemic agents with the target blood glucose maintained between 140 and 180 mg/dL.

Surgical Procedure
Laparoscopic Cholecystectomy
Patients in Group A underwent laparoscopic cholecystectomy under general anaesthesia using the conventional four-port technique. Pneumoperitoneum was established using either the Veress needle or open Hasson technique. The cystic duct and cystic artery were identified after obtaining the critical view of safety, clipped, and divided. The gallbladder was dissected from the liver bed using electrocautery and extracted through the umbilical port. Conversion to open surgery was performed when necessary because of dense adhesions, unclear anatomy, uncontrolled bleeding, or suspected bile duct injury.

Open Cholecystectomy
Patients in Group B underwent open cholecystectomy through a standard right subcostal (Kocher's) incision under general anaesthesia. After identification and ligation of the cystic duct and artery, the gallbladder was dissected from the liver bed. Hemostasis was secured, and drains were placed selectively according to intraoperative findings before closure of the abdominal wall.

Intraoperative Assessment
The following intraoperative variables were recorded:
- Operative time (minutes)
- Estimated blood loss
- Intraoperative complications
- Difficulty in dissection
- Requirement of drain placement
- Conversion from laparoscopic to open surgery
- Intraoperative glycemic fluctuations

Postoperative Management
All patients received standardized postoperative care, including intravenous fluids, analgesics, antibiotics, and glycemic control using insulin according to institutional protocols. Blood glucose levels were monitored every four to six hours during the immediate postoperative period. Early ambulation and gradual oral feeding were encouraged as tolerated.

Outcome Measures

Primary Outcome Measures

- Postoperative pain assessed using the Numeric Rating Scale (NRS).
- Surgical site infection.
- Duration of hospital stay.
- Time to return to normal daily activities.
- Overall postoperative complications.

Secondary Outcome Measures

- Operative time.
- Intraoperative blood loss.
- Need for intensive care.
- Conversion rate from laparoscopic to open surgery.
- Glycemic control during the perioperative period.

Follow-up

Patients were evaluated during hospital stay and subsequently followed at 1 week, 1 month, and 3 months after surgery. Follow-up included assessment of wound healing, postoperative pain, glycemic control, surgical site infection, biliary complications, and return to routine activities.

Data Collection

Data were recorded using a predesigned structured case record form. Demographic details, clinical findings, operative parameters, postoperative outcomes, complications, and follow-up observations were entered into Microsoft Excel and verified for accuracy before statistical analysis.

Statistical Analysis

Data were analysed using Statistical Package for Social Sciences (SPSS) version 25.0. Continuous variables were expressed as mean ± standard deviation and compared using the independent Student's *t*-test. Categorical variables were expressed as frequencies and percentages and analysed using the Chi-square test or Fisher's exact test whenever appropriate. Postoperative pain scores were compared using the Mann–Whitney U test. A *p*-value of <0.05 was considered statistically significant.

RESULTS AND OBSERVATIONS

Table 1. Baseline demographic and clinical characteristics of study participants (n = 102)

Variable	Value
Total participants	**102**
Mean age (years)	**46.17 ± 17.05**
Age range (years)	**19–75**
Male	**38 (37.3%)**
Female	**64 (62.7%)**
ASA Grade II	**82 (80.4%)**
ASA Grade III	**20 (19.6%)**

Interpretation: Female patients predominated in the study population. The mean age was 46.17±17.05 years, and most patients belonged to ASA Grade II.

Table 2. Comparison of operative characteristics between laparoscopic and open cholecystectomy

Variable	LC (n=51)	OC (n=51)	p-value
Operative time (minutes)	**72 ± 14**	**60 ± 18**	**<0.001**
Blood loss (ml)	**40 ± 15**	**90 ± 30**	**<0.001**
Drain insertion	**14 (27.5%)**	**38 (74.5%)**	**<0.001**
Conversion to open surgery	**3 (5.8%)**	**—**	**—**

Interpretation: Open cholecystectomy required significantly less operative time, whereas laparoscopic cholecystectomy resulted in significantly lower blood loss and drain requirement.

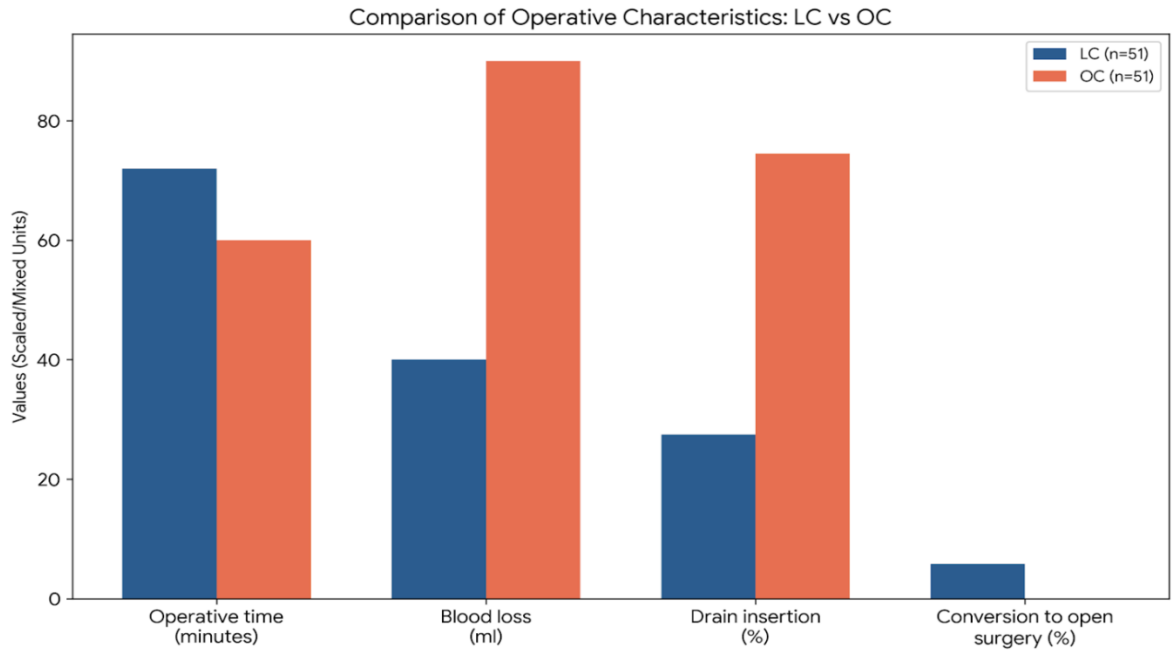

Table 3. Comparison of postoperative pain scores

Time	LC	OC	p-value
6 hours	3.2 ±1.1	6.5 ±1.4	<0.001
24 hours	2.5 ±0.9	5.8 ±1.2	<0.001
48 hours	1.8 ±0.7	4.9 ±1.0	<0.001

Interpretation: Pain scores were significantly lower in the laparoscopic group at all postoperative time points.

Table 4. Recovery outcomes

Variable	LC	OC	p-value
Hospital stay (days)	2.92 ±0.85	6.18 ±1.41	<0.001
ICU admission	3 (5.9%)	8 (15.7%)	0.110
Return to normal activity	Earlier	Delayed	<0.001

Interpretation: Patients undergoing laparoscopic cholecystectomy had significantly shorter hospitalization and earlier recovery.

Table 5. Intraoperative outcomes

Variable	LC	OC	p-value
Intraoperative complications	10 (19.6%)	7 (13.7%)	0.425
Bile leak	2 (3.9%)	1 (2.0%)	1.000
Conversion to open	3 (5.8%)	—	—

Interpretation: Intraoperative complication rates were comparable between the two groups.

Table 6. Postoperative complications

Complication	LC	OC	p-value
Surgical site infection	2 (3.9%)	6 (11.8%)	0.490
Postoperative ileus	2 (3.9%)	5 (9.8%)	0.240
Overall complications	9 (17.6%)	33 (64.7%)	0.425

Interpretation: Overall postoperative complications were numerically lower following laparoscopic cholecystectomy.

Table 7. Drain-related outcomes

Variable	LC	OC	p-value
Drain insertion	14 (27.5%)	38 (74.5%)	<0.001
Drain >3 days	3 (5.9%)	15 (29.4%)	0.002

Interpretation: Drain insertion and prolonged drainage were significantly more frequent after open cholecystectomy.

Table 8. Association of glycemic control with postoperative outcomes

Variable	No SSI	SSI	p-value
HbA1c	8.20 ±1.05	8.31 ±0.97	0.695
Duration of diabetes (years)	9.78 ±6.30	10.73 ±5.59	0.584
HbA1c vs Hospital stay (r)	0.019	—	0.848

Interpretation: HbA1c and duration of diabetes showed no significant association with postoperative wound infection or duration of hospitalisation.

Table 9. Association of BMI and ASA grade with surgical outcomes

Variable	Statistical test	p-value
BMI vs conversion to open surgery	Independent t-test	0.736
ASA grade vs intraoperative complications	Chi-square	0.478

Interpretation: Neither BMI nor ASA grade demonstrated a significant association with adverse intraoperative outcomes.

DISCUSSION

The present study compared postoperative outcomes between laparoscopic and open cholecystectomy in diabetic patients and demonstrated several advantages of the laparoscopic approach. Although operative time was significantly longer in the laparoscopic group, patients experienced substantially lower blood loss, reduced postoperative pain, shorter hospital stay, earlier return to normal activities, and fewer postoperative complications.

In the present study, the mean age of participants was 46.17 ± 17.05 years, with female predominance (62.7%). This observation is consistent with previous epidemiological studies showing that gallstone disease occurs more frequently in women because of hormonal influences on cholesterol metabolism and gallbladder motility (1,9).

Operative time was significantly longer in the laparoscopic group compared with open cholecystectomy. Similar findings have been reported by Keus et al. and Coccolini et al., who attributed the longer operative duration to trocar placement, establishment of pneumoperitoneum, and careful laparoscopic dissection to obtain the critical view of safety (3,10). However, despite requiring more operative time, laparoscopic surgery resulted in significantly less intraoperative blood loss, reflecting the superior visualization and meticulous dissection achievable with minimally invasive techniques.

Postoperative pain scores at 6, 24, and 48 hours were significantly lower following laparoscopic cholecystectomy. Reduced tissue trauma, smaller incisions, and minimal abdominal wall disruption contribute to decreased postoperative pain, allowing earlier mobilization and reduced analgesic requirements. These findings agree with previous randomized trials and systematic reviews that consistently reported improved postoperative comfort after laparoscopic surgery (3,11). Hospital stay was significantly shorter in the laparoscopic group, with patients returning to normal daily activities considerably earlier than those undergoing open cholecystectomy. Similar observations have been reported in multiple comparative studies demonstrating that minimally invasive surgery accelerates postoperative recovery, decreases healthcare costs, and improves patient satisfaction (8,10).

Although intraoperative complication rates were comparable between both groups, postoperative complications such as surgical site infection and postoperative ileus occurred less frequently in patients undergoing laparoscopic surgery. Diabetes predisposes patients to impaired wound healing and postoperative infections due to microvascular disease and immune dysfunction. Smaller incisions and limited tissue handling during laparoscopic surgery likely contributed to the reduced incidence of wound-related complications observed in this study (5,12).

The conversion rate from laparoscopic to open surgery was 5.8%, which is comparable with rates reported in previous literature ranging from 2% to 10%. Dense adhesions, difficult anatomy, uncontrolled bleeding, and unclear visualization remain the most common indications for conversion. Conversion should not be considered a complication but rather a decision made in the interest of patient safety (4,13).

Drain insertion and prolonged drainage were significantly more frequent following open cholecystectomy. Increased tissue dissection and larger operative fields often necessitate drainage in open procedures, whereas laparoscopic surgery generally causes less tissue trauma and fluid collection (10).

Interestingly, the present study did not demonstrate a significant association between HbA1c levels and postoperative wound infection or hospital stay. Although poor glycemic control has been associated with increased postoperative morbidity in many studies, effective perioperative glycemic optimization may have minimized differences in our patient population (5,14).

Overall, the findings of the present study support laparoscopic cholecystectomy as the preferred surgical approach for diabetic patients with symptomatic cholelithiasis whenever feasible. The procedure offers better postoperative recovery, reduced pain, decreased blood loss, shorter hospitalization, and fewer wound-related complications while maintaining comparable intraoperative safety. Nevertheless, open cholecystectomy remains an important alternative in selected patients with complicated gallbladder disease or difficult operative anatomy.

CONCLUSION

Laparoscopic cholecystectomy demonstrated superior postoperative outcomes compared with open cholecystectomy in diabetic patients. Despite a longer operative time, it was associated with significantly lower blood loss, reduced postoperative pain, shorter hospital stay, earlier return to normal activities, and fewer postoperative complications. Therefore, laparoscopic cholecystectomy should be considered the preferred surgical approach for diabetic patients with symptomatic cholelithiasis whenever feasible, while open cholecystectomy remains an effective option in selected complex cases.

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