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# Early Outcomes and Complications of Laparoscopic Cholecystectomy in Diabetic vs. Non- Diabetic Patients

**[1]Dr. Aman Ullah, [2]Dr. Muhammad Azhar Qureshi, [3]Dr.S. Iftikhar Alam, [4]Dr Abdulsattar Abro, [5]Dr Shahzada Amir Ahmed Babar, [6]Syed Danish Mehmood**

[1]FCPS, general surgery Pakistan Petroleum Limited Sui field hospital, Sui Balochistan.
[2]Associate Professor Surgery Rawal Institute of Health Sciences Islamabad.
[3]Assistant Professor Department of Surgery KMU-IMS DHQ teaching hospital KDA Kohat.
[4]Associate Professor Surgery Chandka Medical College Larkana SMBBMU.
[5]Associate Professor General Surgery Bolan medical college Quetta.
[6]Consultant orthopaedic dept Islamabad medical complex, Nescom.

**Background:** Laparoscopic cholecystectomy (LC) is the gold-standard treatment for symptomatic gallstone disease, offering reduced postoperative pain, shorter hospital stay, and faster recovery compared to open surgery (1,2). Diabetes mellitus is associated with altered immune function, microvascular disease, and delayed wound healing, potentially increasing perioperative risks (3,4). Understanding early outcomes and complications in diabetic versus non-diabetic patients undergoing LC is critical for optimizing surgical strategies and perioperative care (5,6)..

**Objective:**
To compare early postoperative outcomes and complications of LC between diabetic and non-diabetic patients, and to assess the influence of diabetes on surgical recovery and complication rates.

**Methods:** A prospective observational study was conducted at a tertiary-care surgical unit between January 2022 and December 2024. Adult patients undergoing elective or emergency LC were categorized into diabetic and non-diabetic groups based on preoperative diagnosis and laboratory confirmation (7). Data included demographic details, comorbidities, operative findings, conversion to open surgery, intra- and postoperative complications, and length of hospital stay (8,9). Secondary data from published multicenter studies and local hospital records were integrated to strengthen comparative analysis (10,11). A short patient survey assessed subjective recovery experience and satisfaction with outcomes (12)..

**Results:** A total of 240 patients were included: 110 diabetics and 130 non-diabetics. Diabetic patients had a higher incidence of intraoperative difficulty, including adhesions (32% vs. 18%), gallbladder wall thickening (41% vs. 21%), and need for subtotal cholecystectomy (6% vs. 2%) . Conversion to open surgery occurred in 8.2% of diabetics versus 3.1% of non-diabetics . Postoperative complications were more frequent among diabetics, notably surgical-site infection (7% vs. 2%), bile leak (3% vs. 1%), and prolonged ileus (4% vs. 0.8%) (13,14). Mean hospital stay was longer for diabetics (4.2 ± 1.1 days) compared to non-

GLOBAL HEALTH & MEDICINE
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Volume 08, Issue 06.
https://ghsjournal.com/

diabetics (3.1 ± 0.9 days) . Survey responses indicated delayed return to normal activity in diabetics (median: 12 vs. 9 days) .

**Conclusion**: Diabetes is associated with more challenging intraoperative findings, higher conversion rates, and increased postoperative morbidity following LC. Enhanced perioperative optimization, meticulous glycemic control, and early surgical intervention may improve outcomes in diabetic patients (15). These findings underscore the need for tailored surgical planning and targeted postoperative monitoring in this high-risk group.

**Keywords:** Laparoscopic cholecystectomy, diabetes mellitus, surgical outcomes, postoperative complications, conversion rate, gallbladder surgery, glycemic control.

## Introduction:

Laparoscopic cholecystectomy (LC) has replaced open cholecystectomy as the standard surgical procedure for symptomatic cholelithiasis due to its minimally invasive nature, reduced postoperative pain, shorter hospital stay, and faster recovery times (1,2). Since its introduction in the late 1980s, LC has evolved into a safe and efficient procedure, with complication rates significantly lower than those observed with the open approach (3). Despite these advantages, the presence of comorbid conditions—particularly diabetes mellitus—can alter the perioperative risk profile and influence recovery trajectories (4,5).Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia and associated microvascular, macrovascular, and immune system dysfunctions (6). These physiological alterations can negatively impact surgical outcomes by delaying wound healing, increasing susceptibility to infection, and impairing tissue perfusion (7). In the context of LC, diabetic patients may present with a higher incidence of complicated gallbladder pathology, such as empyema, gangrene, or chronic inflammation, which may necessitate technical modifications or conversion to open surgery (8,9). Furthermore, perioperative glycemic fluctuations can exacerbate the systemic inflammatory response, potentially prolonging hospital stay and delaying return to normal activity (10).

Several studies have reported that diabetic patients undergoing LC are at increased risk of intraoperative challenges, including dense adhesions, contracted gallbladder, and altered Calot's triangle anatomy (1,8). These anatomical variations may result from chronic inflammation and fibrosis associated with gallbladder disease in diabetics (4,11). As a consequence, surgeons often encounter prolonged operative times, greater blood loss, and an increased need for bailout procedures such as subtotal cholecystectomy (8,12). Evidence also suggests that delayed surgical intervention, particularly in acute cholecystitis cases, can

GLOBAL HEALTH & MEDICINE
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Volume 08, Issue 06.
https://ghsjournal.com/

further amplify morbidity in diabetic patients, leading to higher rates of surgical-site infection, bile duct injury, and reoperation (5,13).In addition to intraoperative complexity, postoperative outcomes differ significantly between diabetic and non-diabetic populations. Diabetic patients are reported to have higher rates of wound infection, postoperative ileus, pulmonary complications, and prolonged hospitalization (9,14). This may be partly explained by impaired leukocyte function and diminished collagen synthesis in hyperglycemic states, which compromise tissue repair and immune defense (6,7). Optimizing perioperative glycemic control through multidisciplinary proocols has been shown to mitigate some of these risks, highlighting the importance of preoperative preparation and postoperative monitoring (15).

Despite growing recognition of these disparities, there is limited contemporary data from large, diverse patient populations that specifically compare early LC outcomes in diabetics versus non-diabetics while accounting for confounding variables such as age, BMI, and comorbid cardiovascular disease (2,3). Many published studies focus primarily on acute cholecystitis or include heterogeneous surgical techniques, making it challenging to draw firm conclusions regarding elective versus emergency LC in the diabetic subgroup (8,12). Moreover, few analyses integrate local hospital data with broader multicenter research findings, an approach that could yield more contextually relevant insights for surgical planning and policy development.

The present study addresses this gap by conducting a comprehensive comparative analysis of early postoperative outcomes and complications of LC in diabetic and non-diabetic patients at a tertiary-care center, supplemented by secondary data from recent multicenter studies and local institutional records. Additionally, a short patient-reported outcomes survey was incorporated to evaluate subjective recovery experience, which remains underexplored in existing literature. Our primary hypothesis is that diabetes is independently associated with greater intraoperative difficulty, higher conversion rates, and increased postoperative morbidity in LC patients. The findings are expected to inform surgical decision-making, perioperative management strategies, and patient counseling, ultimately aiming to improve recovery and reduce complication rates in this high-risk population..

## Materials and Methods

### Study Design and Setting

This prospective observational study was conducted at the Department of General Surgery, [DHQ hospital], a tertiary-care referral center, between January 2022 and December 2024. The protocol was approved by the institutional ethics committee, and written informed consent was obtained from all participants prior to inclusion. The study compared early outcomes and complications of laparoscopic cholecystectomy (LC) in diabetic versus non-diabetic patients, integrating primary hospital-based data with secondary published sources for comparative analysis (1,2). A small postoperative patient survey was also conducted to assess subjective recovery.

GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
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https://ghsjournal.com/

## Population and Sampling Method

### Study Population

- Eligible participants were adults (≥18 years) scheduled for elective or emergency LC for symptomatic gallstone disease. Patients were divided into two groups:
- **Diabetic group**: Patients with a preoperative diagnosis of diabetes mellitus, confirmed via fasting plasma glucose ≥126 mg/dL, HbA1c ≥6.5%, or ongoing anti-diabetic therapy (3).
- **Non-diabetic group**: Patients without a history or laboratory evidence of diabetes.
- Exclusion criteria included: severe cardiopulmonary instability, ASA (American Society of Anesthesiologists) physical status class IV or V, concurrent major abdominal surgery, gallbladder malignancy, or inability to provide consent (4,5).

### Preoperative Assessment

All patients underwent a standardized preoperative evaluation, including history, physical examination, laboratory investigations (complete blood count, liver function tests, renal profile, coagulation profile), fasting blood glucose, and HbA1c (for suspected diabetics). Abdominal ultrasonography was performed to assess gallbladder wall thickness, presence of gallstones, pericholecystic fluid, and biliary tree anatomy (6). Diabetic patients received optimization of glycemic control prior to surgery, with target preoperative fasting glucose <140 mg/dL where feasible (7).

### Operative Technique

All procedures were performed under general anesthesia by experienced laparoscopic surgeons with a minimum of 100 prior LC cases. A standard four-port LC technique was employed (8). Pneumoperitoneum was established with $CO_2$ at 12–14 mmHg intra-abdominal pressure, unless patient-specific conditions required modification (9). Critical view of safety (CVS) was obtained before ligation of the cystic duct and artery, with intraoperative cholangiography used selectively (10). In cases with dense adhesions, contracted gallbladder, or unclear anatomy, conversion to open cholecystectomy or subtotal cholecystectomy was undertaken (11,12).

### Intraoperative and Postoperative Data Collection

Data collected included:

- **Demographics**: Age, sex, body mass index (BMI), comorbidities.
- **Operative variables**: Operative time, intraoperative findings (adhesions, gallbladder wall thickness), blood loss, bile spillage, conversion to open surgery, and use of bailout procedures (13,14).

GLOBAL HEALTH & MEDICINE
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- **Postoperative outcomes**: Surgical-site infection (SSI), bile leak, intra-abdominal abscess, postoperative ileus, pulmonary complications, length of hospital stay, and readmission within 30 days.

All complications were classified according to the Clavien–Dindo system (15).

**Survey Component**

A structured questionnaire was administered to patients on postoperative day 7 and at the 30-day follow-up. This survey assessed:

- Pain severity (visual analogue scale)
- Time to return to normal activity
- Overall satisfaction with surgical outcomes

The survey was validated for clarity by a panel of three surgical faculty members prior to use.

**Local Hospital Data Table**

To contextualize findings, a comparative dataset from our institution's surgical registry (January 2020–December 2021) was included, reflecting average LC outcomes in diabetic and non-diabetic patients prior to the study period ). This table provided baseline complication rates and conversion frequencies, enabling comparison of present study outcomes against recent historical performance.

**Secondary Data Integration**

Published multicenter studies from 2018–2024 were reviewed to benchmark our results against broader trends in diabetic versus non-diabetic LC outcomes (1,3,5,8,14). This approach allowed for triangulation of evidence, enhancing the validity of our findings.

**Statistical Analysis**

Continuous variables were expressed as mean ± standard deviation (SD) and compared using Student's t-test or Mann–Whitney U test where appropriate. Categorical variables were presented as frequencies and percentages, and compared using Chi-square or Fisher's exact test. A p-value $<0.05$ was considered statistically significant. Statistical analyses were performed using IBM SPSS Statistics version 26.0 (IBM Corp., Armonk, NY, USA).

Multivariate logistic regression was applied to identify independent predictors of postoperative complications, adjusting for potential confounders including age, BMI, sex, and presence of cardiovascular disease (6,12,15).

GLOBAL HEALTH & MEDICINE
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Volume 08, Issue 06.
https://ghsjournal.com/

**Ethical Considerations**. All patients and healthcare professionals provided informed consent prior to participation. No personally identifiable data were collected or shared. The study was conducted in alignment with national research ethics guidelines and upheld patient confidentiality at all stages of data handling. Ethical clearance was secured from relevant hospital ethics committees .

**Results:**

## Patient Characteristics

A total of 240 patients underwent LC during the study period: 110 in the diabetic group and 130 in the non-diabetic group. Baseline demographic and clinical characteristics are summarized in **Table 1**.

The mean age was higher in diabetics compared to non-diabetics (56.3 ± 8.9 vs. 48.7 ± 9.6 years; $p<0.001$ . Diabetic patients had a higher mean BMI (29.4 ± 3.7 vs. 27.8 ± 3.2 kg/m²; $p=0.002$ and a greater prevalence of hypertension (46% vs. 18%), ischemic heart disease (15% vs. 5%), and chronic kidney disease (6% vs. 1%) ($p<0.05$ for all . The proportion of emergency LC cases was slightly higher among diabetics (24% vs. 19%), though this did not reach statistical significance ($p=0.38$ ).

**Table 1: Baseline demographic and clinical characteristics of study patients ()**

| Variable | Diabetic (n=110) | Non-diabetic (n=130) | p-value |
|---|---|---|---|
| Age (years, mean ± SD) | 56.3 ± 8.9 | 48.7 ± 9.6 | <0.001 |
| Female sex (%) | 68 (61.8%) | 81 (62.3%) | 0.94 |
| BMI (kg/m²) | 29.4 ± 3.7 | 27.8 ± 3.2 | 0.002 |
| Hypertension (%) | 51 (46.4%) | 24 (18.5%) | <0.001 |
| Ischemic heart disease (%) | 17 (15.5%) | 6 (4.6%) | 0.004 |
| Chronic kidney disease (%) | 7 (6.4%) | 2 (1.5%) | 0.046 |
| Emergency LC (%) | 26 (23.6%) | 25 (19.2%) | 0.38 |

### Intraoperative Findings

Diabetic patients exhibited significantly more challenging intraoperative anatomy (1,8,12). Adhesions were present in 35 (31.8%) diabetic cases versus 21 (16.2%) in non-diabetics ($p=0.004$). Gallbladder wall thickening (>4 mm) was observed in 45 (40.9%) diabetics compared to 27 (20.8%) non-diabetics ($p=0.001$). Pericholecystic fluid was more common in diabetics (15% vs. 6%; $p=0.03$).

GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

Conversion to open cholecystectomy occurred in 9 diabetics (8.2%) versus 4 non-diabetics (3.1%) (p=0.09). Subtotal cholecystectomy was performed in 7 diabetic patients and 2 non-diabetic patients due to severe adhesions or distorted anatomy (p=0.04).

Mean operative time was longer in the diabetic group (68.5 ± 12.4 vs. 59.7 ± 11.6 minutes; p<0.001). Estimated intraoperative blood loss was also greater in diabetics (78 ± 25 mL vs. 65 ± 20 mL; p=0.01)

**Postoperative Complications**

Postoperative complication rates were significantly higher in diabetics (**Table 2**), with surgical-site infection (SSI) being the most frequent (7.3% vs. 2.3%; p=0.04). Other complications included bile leak (2.7% vs. 0.8%) and prolonged ileus (4.5% vs. 0.8%). There were no cases of bile duct injury in either group.

**Table 2: Postoperative complications within 30 days**

| Complication | Diabetic (n=110) | Non-diabetic (n=130) | p-value |
|---|---|---|---|
| Surgical-site infection | 8 (7.3%) | 3 (2.3%) | 0.04 |
| Bile leak | 3 (2.7%) | 1 (0.8%) | 0.31 |
| Prolonged ileus | 5 (4.5%) | 1 (0.8%) | 0.07 |
| Pulmonary complications | 2 (1.8%) | 1 (0.8%) | 0.59 |
| Reoperation | 1 (0.9%) | 0 (0.0%) | 0.46 |
| 30-day readmission | 4 (3.6%) | 2 (1.5%) | 0.41 |

| Complication | Diabetic (n=110) | Non-diabetic (n=130) | p-value |
|---|---|---|---|
| **Surgical-site infection** | **8 (7.3%)** | **3 (2.3%)** | **0.04** |
| **Bile leak** | **3 (2.7%)** | **1 (0.8%)** | **0.31** |
| **Prolonged ileus** | **5 (4.5%)** | **1 (0.8%)** | **0.07** |
| **Pulmonary complications** | **2 (1.8%)** | **1 (0.8%)** | **0.59** |
| **Reoperation** | **1 (0.9%)** | **0 (0.0%)** | **0.46** |
| **30-day readmission** | **4 (3.6%)** | **2 (1.5%)** | **0.41** |

## Length of Hospital Stay

GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

Mean hospital stay was significantly longer in diabetics (4.2 ± 1.1 days) compared to non-diabetics (3.1 ± 0.9 days; p<0.001). This difference persisted even when adjusting for emergency cases in a multivariate model (p=0.003).

## DHQ Hospital Data Comparison

A retrospective review of institutional data from January 2020 to December 2021 showed similar trends (**Table 3**), with diabetics exhibiting higher complication rates and longer hospital stays, confirming consistency over time.

**Table 3: Historical local hospital LC outcomes ()**

| Outcome | Diabetic (n=95) | Non-diabetic (n=120) | p-value |
|---|---|---|---|
| Conversion to open (%) | 7 (7.4%) | 4 (3.3%) | 0.21 |
| SSI (%) | 6 (6.3%) | 3 (2.5%) | 0.18 |
| Mean hospital stay (days) | 4.1 ± 1.0 | 3.0 ± 0.8 | <0.001 |


| Outcome | Diabetic (n=95) | Non-diabetic (n=120) | p-value |
|---|---|---|---|
| Conversion to open (%) | 7 (7.4%) | 4 (3.3%) | 0.21 |
| SSI (%) | 6 (6.3%) | 3 (2.5%) | 0.18 |
| Mean hospital stay (days) | 4.1 ± 1.0 | 3.0 ± 0.8 | <0.001 |


### Survey Findings

Of the 240 participants, 215 completed the postoperative survey (response rate 89.6%). Diabetic patients reported higher mean pain scores on postoperative day 7 (VAS: 3.4 ± 1.1 vs. 2.8 ± 0.9; p<0.001) and a longer median time to return to normal activities (12 vs. 9 days; p<0.00). Satisfaction rates were high in both groups but slightly lower in diabetics (91% vs. 96%), though this difference was not statistically significant (p=0.12).

**Table 4: Patient-reported outcomes from survey ()**

| Variable | Diabetic | Non-diabetic | p-value |
|---|---|---|---|
| Pain score (VAS, day 7) | 3.4 ± 1.1 | 2.8 ± 0.9 | <0.001 |
| Return to normal activity (days, median) | 12 (IQR 10–14) | 9 (IQR 8–11) | <0.001 |
| Satisfaction (%) | 91% | 96% | 0.12 |

## Multivariate Analysis

GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

On logistic regression, independent predictors of postoperative complications included:

- **Diabetes mellitus** (OR = 2.36; 95% CI: 1.04–5.37; p=0.04)
- **Emergency surgery** (OR = 2.78; 95% CI: 1.11–6.95; p=0.03)
- **Gallbladder wall thickening >4 mm** (OR = 2.21; 95% CI: 1.02–4.81; p=0.045)

BMI, age, and sex were not independently associated with complication risk after adjustment..

**Discussion:** This study compared early intraoperative and postoperative outcomes of laparoscopic cholecystectomy (LC) in diabetic and non-diabetic patients, integrating local institutional data, secondary multicenter reports, and patient-reported outcome measures. Our findings demonstrate that diabetes mellitus is associated with significantly more challenging operative anatomy, prolonged operative times, and higher rates of postoperative complications, particularly surgical-site infections (SSIs), compared to non-diabetic patients. These results are consistent with previously published literature and reinforce the need for tailored perioperative strategies for diabetic individuals undergoing LC (1–3).

**Comparison with Existing Literature**

The higher prevalence of intraoperative difficulty among diabetic patients in our cohort—characterized by dense adhesions (31.8% vs. 16.2%) and gallbladder wall thickening (40.9% vs. 20.8%)—mirrors the observations of Luthra et al. (1), who attributed these features to chronic inflammatory changes, fibrosis, and microvascular disease. Such changes can distort Calot's triangle anatomy, increasing the risk of bile duct injury if critical view of safety (CVS) is not meticulously achieved. Our conversion to open surgery rate (8.2% vs. 3.1%) is within the range reported by Lauro et al. (4) and Serban et al. (5), both of whom noted higher conversion rates in diabetics with acute cholecystitis or delayed presentation.The operative time difference we observed (mean +8.8 minutes in diabetics) is also supported by Amin et al. (6) and San Lio et al. (7), who emphasized that extensive dissection and adhesiolysis in diabetics often prolong surgery. Importantly, despite longer operative times and more frequent bailout procedures (e.g., subtotal cholecystectomy), we recorded no bile duct injuries—reflecting adherence to safety protocols and early decision-making for conversion when anatomy was unclear (8,9).

Postoperative complications were notably higher among diabetics, especially SSIs (7.3% vs. 2.3%), in line with findings from Ely et al. (2) and AlKhalifah et al. (11), who identified diabetes as an independent risk factor for surgical-site infection after LC. Pathophysiological explanations include impaired neutrophil chemotaxis, reduced macrophage function, and

GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

diminished collagen deposition in hyperglycemic states (6,15). Our SSI rate in diabetics, though higher than in non-diabetics, was lower than in some historical series (4,5), likely reflecting standardized perioperative antibiotic prophylaxis, improved skin preparation, and glycemic optimization protocols implemented in our unit.

The incidence of other complications—such as bile leak and prolonged ileus—was low but still numerically higher in diabetics, consistent with reports by Randall et al. (3) and Sato et al. (12). Although these differences did not always reach statistical significance, the trends reinforce the importance of vigilant postoperative monitoring in diabetic patients.Our finding that mean hospital stay was longer in diabetics (4.2 vs. 3.1 days) aligns with Serban et al. (5) and Zhang et al. (15), who linked diabetes to delayed recovery and longer postoperative observation periods, especially in the presence of complications. Even after adjusting for emergency cases, the length-of-stay difference persisted, suggesting that factors beyond surgical urgency—such as slower wound healing and more frequent comorbidity management—contribute to extended hospitalization.

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## Survey Insights

The addition of a patient-reported outcomes survey offers a novel dimension to the literature. Diabetics reported higher pain scores on postoperative day 7 and longer median times to return to normal activity (12 vs. 9 days). While some of this may be explained by differences in complication rates, psychological factors such as greater anxiety about wound healing and a more cautious approach to physical activity may also play roles. Comparable findings were noted in patient-reported datasets from Dominguez et al. (8) and Othman et al. (10), which emphasized that subjective recovery timelines are influenced not only by physiological healing but also by patient perception and self-care practices.

## Possible Mechanisms

The observed disparities in outcomes between diabetic and non-diabetic patients likely result from multifactorial mechanisms:

1. **Microvascular and Macrovascular Disease** – Diabetes causes endothelial dysfunction and reduces tissue perfusion, delaying healing and increasing infection risk (6,15).
2. **Impaired Immunity** – Hyperglycemia inhibits leukocyte migration and phagocytosis, predisposing to postoperative infections (5,11).
3. **Chronic Inflammation** – Longstanding cholelithiasis in diabetics may lead to chronic cholecystitis with fibrosis, adhesions, and distorted biliary anatomy (1,4,8).
4. **Glycemic Fluctuations** – Perioperative glucose variability amplifies oxidative stress and systemic inflammatory responses, potentially worsening recovery (7,9).

GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

## Clinical Implications

Our findings have several practical implications:

- **Preoperative Optimization** – Stringent glycemic control prior to surgery can reduce SSI risk and improve wound healing. Preoperative HbA1c assessment should be standard for elective LC in diabetics (6,15).
- **Surgical Planning** – Anticipating difficult anatomy in diabetics allows for early preparation for possible conversion, ensuring necessary instruments and team readiness.
- **Enhanced Recovery Protocols** – Early mobilization, adequate analgesia, and nutritional optimization can help mitigate prolonged recovery in diabetics (2,10).
- **Postoperative Surveillance** – Diabetics may benefit from extended wound monitoring and early intervention for signs of infection or delayed healing.

## Strengths and Limitations

A strength of this study is the integration of prospective primary data with local historical controls and multicenter secondary data, providing both internal and external validity. Additionally, the incorporation of patient-reported outcomes offers insight into subjective recovery—an area often overlooked in surgical outcome studies.However, there are limitations. First, while our sample size was adequate for detecting differences in common complications, rarer events such as bile duct injury could not be meaningfully compared. Second, although we adjusted for some confounders in multivariate analysis, residual confounding by unmeasured variables (e.g., duration of diabetes, perioperative glucose fluctuation patterns) is possible. Third, follow-up was limited to 30 days; long-term outcomes such as incisional hernia rates or late biliary complications were not assessed.

## Comparison with Guidelines

Our results are in line with the Tokyo Guidelines 2018 (13) and the World Society of Emergency Surgery recommendations (14), which emphasize early cholecystectomy for acute cholecystitis in high-risk groups, including diabetics, to reduce complication rates. These guidelines also advocate for individualized perioperative risk stratification—an approach supported by our data.

## Future Directions

Further research should focus on:

- Evaluating the impact of intensive perioperative glycemic control protocols on LC outcomes in diabetics.
- Exploring the role of newer minimally invasive techniques, such as robotic-assisted cholecystectomy, in reducing complication rates for difficult gallbladders in diabetics.

GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
https://ghsjournal.com/

- Incorporating long-term follow-up and cost-effectiveness analysis to better understand the broader implications of diabetes on gallbladder surgery outcomes.

## Summary

In summary, this study confirms that diabetes mellitus is associated with more complex intraoperative findings, longer operative times, higher rates of SSIs, and slower functional recovery following LC. While overall morbidity remains low, targeted perioperative optimization, careful surgical planning, and enhanced postoperative care are essential for improving outcomes in this vulnerable patient population.

## Conclusion

This study demonstrates that diabetes mellitus substantially influences the perioperative outcomes of laparoscopic cholecystectomy, with diabetic patients exhibiting a higher frequency of technically challenging intraoperative findings, such as dense adhesions, gallbladder wall thickening, and distorted biliary anatomy, which were associated with longer operative times, increased blood loss, and a greater need for bailout procedures, including subtotal cholecystectomy (1,4,8). Postoperatively, diabetic patients experienced higher rates of surgical-site infection and other complications compared with non-diabetic patients, findings that are consistent with prior multicenter studies (2,5,11). These complications, coupled with slower wound healing and comorbidity management demands, contributed to significantly longer hospital stays in the diabetic group, even after adjusting for emergency surgery status . Patient-reported outcome measures further indicated a delayed return to normal activity and higher pain scores in diabetic individuals during the early postoperative period (), underscoring the broader impact of diabetes on functional recovery. From a surgical practice perspective, these results highlight the critical need for comprehensive perioperative optimization in diabetic patients, including stringent glycemic control, timely operative intervention for acute cholecystitis, meticulous adherence to safety protocols to minimize bile duct injury risk, and proactive postoperative surveillance to identify and address complications early (13–15). Incorporating diabetic-specific considerations into enhanced recovery after surgery (ERAS) protocols, ensuring multidisciplinary involvement from endocrinologists to anesthesiologists, and exploring the use of advanced minimally invasive techniques may further improve outcomes. Overall, while laparoscopic cholecystectomy remains safe for diabetics, targeted, individualized perioperative strategies are essential to reduce morbidity, enhance recovery, and optimize both clinical and patient-reported results in this high-risk surgical population.

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GLOBAL HEALTH & MEDICINE
ISSN / eISSN: 2434-9186 / 2434-9194
Volume 08, Issue 06.
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