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Original Research Article

Comparative Study of Operative Complications in Diabetic & Non-Diabetic Individuals in Adult Age Group After Laparoscopic Cholecystectomy

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Abstract: *Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic gallstone disease. However, diabetes mellitus (DM) is associated with an increased risk of postoperative complications, including surgical site infections (SSIs), delayed wound healing, and prolonged recovery. In Pakistan, where both gallstone disease and diabetes have a high prevalence, limited research has been conducted on the impact of diabetes on surgical outcomes following LC. This study aims to compare operative complications in diabetic and non-diabetic individuals undergoing LC in a tertiary care hospital.* ***Methods:*** *This prospective comparative study was conducted at the tertiary care hospital from April 2024 to September 2024. A total of 90 adult patients undergoing elective LC were enrolled and categorized into two groups: diabetics (n = 45) and non-diabetics (n = 45). Preoperative evaluation included fasting blood sugar, HbA1c, and imaging assessments. Intraoperative parameters such as operative time, bleeding, and gallbladder perforation were recorded. Postoperative complications, including SSIs, bile leakage, postoperative bleeding, hospital stay, and readmission rates, were monitored. Data were analyzed using SPSS version 26, with $p<0.05$ considered statistically significant.* ***Results:*** *Diabetic patients had significantly longer operative times (48.6 ± 10.2 minutes vs. 42.3 ± 9.5 minutes, p=0.01) and higher intraoperative blood loss compared to non-diabetics. Postoperative SSIs were more frequent in diabetics (24.4% vs. 8.9%, p=0.04), as were readmissions within 30 days (15.6% vs. 4.4%, p=0.03). The mean hospital stay was longer in diabetics (3.8 ± 1.2 days vs. 2.9 ± 0.9 days, p=0.02), and return to normal activities was delayed (10.5 ± 2.4 days vs. 7.9 ± 2.1 days, p=0.01). The overall incidence of bile leakage and postoperative bleeding was higher in diabetic patients, though not statistically significant.* ***Conclusion:*** *Diabetic patients undergoing LC are at a significantly higher risk of prolonged operative times, increased SSIs, longer hospital stays, and delayed recovery compared to non-diabetic individuals. These findings highlight the need for strict perioperative glycemic control, optimized surgical techniques, and extended postoperative monitoring in diabetic patients. Given the rising prevalence of diabetes in Pakistan, implementing targeted strategies to minimize perioperative complications in diabetic individuals is crucial for improving surgical outcomes.*

Keywords: Laparoscopic cholecystectomy, Diabetes mellitus, surgical complications, surgical site infections, Postoperative outcomes, Pakistan

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Introduction

Laparoscopic cholecystectomy (LC) is the gold standard treatment for symptomatic gallstone disease, offering advantages such as reduced postoperative pain, shorter hospital stays, and quicker recovery compared to open cholecystectomy (1). However, diabetes mellitus (DM) is a well-recognized risk factor for adverse surgical outcomes due to its association with delayed wound healing, increased infection susceptibility, and higher perioperative morbidity and mortality rates (2). The prevalence of diabetes in Pakistan has reached alarming levels, with an estimated 33 million adults affected, making it one of the most significant public health concerns in the region (3). Given the high burden of both gallstone disease and diabetes in Pakistan, it is crucial to evaluate how diabetes influences perioperative complications following LC.

Patients with diabetes undergoing LC are at an increased risk of developing surgical site infections (SSIs), bile leaks, and prolonged hospital stays compared to non-diabetic individuals (4). Poor glycemic control can further exacerbate complications by impairing immune function and increasing the likelihood of microvascular damage (5). Several international studies have demonstrated that diabetic patients experience higher rates of postoperative infections and longer recovery times after LC; however, there is limited data specific to the Pakistani population, where factors such as dietary habits, healthcare access, and genetic predispositions may influence outcomes (6).

In Pakistan, gallstone disease is highly prevalent due to dietary patterns rich in saturated fats, obesity, and metabolic disorders, which are also linked to an increased risk of type 2 diabetes (7). Studies have shown that diabetic patients undergoing abdominal surgeries in low-resource settings like Pakistan have a higher risk of complications due to delayed healthcare access, limited perioperative glycemic control, and variability in surgical expertise (8). Despite advancements in minimally invasive surgical techniques, a lack of standardized perioperative care protocols for diabetic patients undergoing LC remains a challenge in Pakistan, leading to inconsistent clinical outcomes (9).

While international guidelines emphasize optimizing perioperative glucose control to reduce surgical complications, there is a need for region-specific research to assess the effectiveness of these measures in Pakistan (10). Identifying risk factors specific to diabetic individuals undergoing LC can help in refining perioperative management strategies, improving surgical outcomes, and reducing healthcare costs associated with postoperative complications.

This study aims to compare the operative complications between diabetic and non-diabetic individuals undergoing LC at a tertiary care hospital in Pakistan. By analyzing intraoperative parameters, postoperative complications, and recovery patterns, this research seeks to provide evidence-based recommendations for optimizing surgical outcomes in diabetic patients. The findings will contribute to developing tailored perioperative care strategies, ultimately improving patient safety and surgical success rates in the Pakistani healthcare system.

Methodology

This prospective comparative study was conducted at a tertiary care hospital over a six-month period, from April 2024 to September 2024, to evaluate and compare operative complications in diabetic and non-diabetic individuals undergoing laparoscopic cholecystectomy. The study included adult patients aged 18 years and above who were diagnosed with symptomatic gallstone disease and scheduled for elective laparoscopic cholecystectomy. Patients were categorized into two groups: diabetics (with a confirmed diagnosis of diabetes mellitus based on fasting blood glucose levels ≥126 mg/dL or HbA1c ≥6.5%) and non-diabetics. Exclusion criteria included patients with uncontrolled diabetes, insulin-dependent diabetes mellitus, previous upper abdominal surgeries, acute cholecystitis, gallbladder malignancy, bleeding disorders, or those who required conversion to open surgery due to intraoperative complications unrelated to diabetes.

Patients were enrolled using a non-probability consecutive sampling technique. Preoperative assessments included a detailed medical history, physical examination, and laboratory investigations, including fasting blood sugar, HbA1c, complete blood count, liver function tests, and coagulation profile. Ultrasonography was performed to assess gallbladder pathology and rule out complications such as perforation, pericholecystic fluid, or bile duct involvement. Standardized preoperative glycemic control was ensured in diabetic patients through insulin or oral hypoglycemic agents, maintaining perioperative blood glucose levels below 180 mg/dL.

All laparoscopic cholecystectomies were performed by experienced surgeons following a standardized four-port technique under general anesthesia. Operative time, intraoperative bleeding, gallbladder perforation, and need for conversion to open surgery were recorded. Postoperatively, patients were monitored for surgical site infections, bile leakage, postoperative bleeding, and hospital stay duration. Readmission rates and recovery times were also assessed. Antibiotic prophylaxis was administered to all patients preoperatively and continued postoperatively in diabetic patients based on institutional infection control protocols. Pain management and postoperative mobilization were standardized across both groups.

The Institutional Review Board (A/28/ERC/147/24) granted ethical approval for the study. Written informed consent was obtained from all participants prior to their inclusion in the study. Patient confidentiality was maintained by anonymizing data, and all procedures adhered to the ethical principles outlined in the Declaration of Helsinki.

Data collection was conducted using a structured proforma, and statistical analysis was performed using SPSS version 26. Continuous variables such as age, BMI, operative time, and hospital stay were presented as mean ± standard deviation, while categorical variables such as presence of complications were expressed as frequencies and percentages. The chi-square test was used to compare categorical variables, and an independent t-test was applied for continuous variables. A p-value of <0.05 was considered statistically significant.

Results

A total of 90 adult patients undergoing LC were included in the study, with 45 diabetic and 45 non-diabetic individuals. The mean age of the participants was 48.2 ± 8.6 years, with a female predominance (63.3%). The majority of the patients had symptomatic gallstone disease, and comorbidities such as hypertension and obesity were more prevalent among diabetic patients. The demographic characteristics of the study participants are summarized in Table 1.

Table 1 presents the demographic and clinical characteristics of the study population. Diabetic patients had a significantly higher mean BMI (p = 0.02) and prevalence of hypertension (p = 0.01) compared to non-diabetic individuals, indicating a greater burden of comorbidities in the diabetic group.

The intraoperative parameters, including operative time, bleeding, and conversion to open surgery, were assessed in both groups. The data are presented in Table 2.

Table 2 shows that diabetic patients had significantly longer operative times (p = 0.01) and higher intraoperative blood loss (p = 0.02) compared to non-diabetic patients. The rate of gallbladder perforation and conversion to open surgery was higher in diabetic patients, although not statistically significant.

The postoperative outcomes, including surgical site infections (SSIs), bile leakage, and readmission rates, were compared between both groups. The results are detailed in Table 3.

Table 3 demonstrates a significantly higher rate of SSIs (p = 0.04) and readmissions (p = 0.03) in diabetic patients compared to non-diabetic individuals. Bile leakage and postoperative bleeding were more frequent in the diabetic group, although these differences were not statistically significant.

The duration of hospital stay and postoperative recovery time were assessed and presented in Table 4.

Table 4 shows that diabetic patients had significantly longer hospital stays (p = 0.02) and delayed return to normal activities (p = 0.01) compared to non-diabetic individuals, emphasizing the impact of diabetes on postoperative recovery.

These findings highlight the increased risk of operative complications in diabetic patients undergoing laparoscopic cholecystectomy, reinforcing the need for enhanced perioperative glycemic control, meticulous surgical techniques, and extended postoperative monitoring in this high-risk population. Future multicenter studies with larger sample sizes are recommended to further validate these findings and refine surgical strategies for diabetic patients.

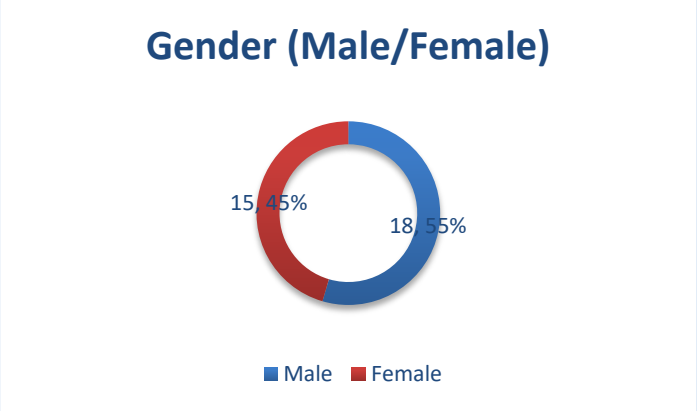

Figure 1: Distribution of gender in study population.

Table 1: Demographic and Clinical Characteristics of Study Participants

Variable	Diabetic (n=45)	Non-Diabetic (n=45)	p-value
Mean Age (years ± SD)	49.6 ± 7.8	46.8 ± 9.2	0.18
Gender (Male/Female)	18/27	15/30	0.44
BMI (kg/m² ± SD)	29.1 ± 3.5	26.8 ± 3.2	0.02*
Hypertension (%)	27 (60.0%)	14 (31.1%)	0.01*
Smoking (%)	15 (33.3%)	11 (24.4%)	0.32

Table 2: Intraoperative Parameters in Diabetic and Non-Diabetic Patients

Parameter	Diabetic (n=45)	Non-Diabetic (n=45)	p-value
Mean Operative Time (min ± SD)	48.6 ± 10.2	42.3 ± 9.5	0.01*
Intraoperative Bleeding (mL ± SD)	58.3 ± 12.5	42.1 ± 10.8	0.02*
Gallbladder Perforation (%)	9 (20.0%)	5 (11.1%)	0.15
Conversion to Open Surgery (%)	4 (8.9%)	1 (2.2%)	0.08

Table 3: Postoperative Complications in Diabetic and Non-Diabetic Patients

Complication	Diabetic (n=45)	Non-Diabetic (n=45)	p-value
Surgical Site Infection (%)	11 (24.4%)	4 (8.9%)	0.04*
Bile Leakage (%)	3 (6.7%)	1 (2.2%)	0.21
Postoperative Bleeding (%)	5 (11.1%)	2 (4.4%)	0.18
Readmission Within 30 Days (%)	7 (15.6%)	2 (4.4%)	0.03*

Table 4: Length of Hospital Stay and Recovery Time

Parameter	Diabetic (n=45)	Non-Diabetic (n=45)	p-value
Mean Hospital Stay (days ± SD)	3.8 ± 1.2	2.9 ± 0.9	0.02*
Time to Resume Normal Activities (days ± SD)	10.5 ± 2.4	7.9 ± 2.1	0.01*

Discussion

The findings of this study demonstrate that diabetes significantly influences perioperative outcomes in patients undergoing laparoscopic cholecystectomy (LC). Our results indicate that diabetic individuals had a higher incidence of postoperative complications, including surgical site infections (SSIs), prolonged hospital stay, and delayed recovery compared to non-diabetic individuals. These findings align with previous studies that have reported increased perioperative morbidity among diabetic patients undergoing minimally invasive procedures.

Our study found that surgical site infections (SSIs) were significantly higher in diabetic patients (24.4%) compared to non-diabetic individuals (8.9%, p=0.04). These findings are consistent with the study by Agrawal et al. (11), who reported a 22% SSI rate in diabetic patients post-LC, attributing the increased risk to poor glycemic control and impaired immune response. Similarly, Singh et al. (12) found that diabetic patients undergoing laparoscopic surgeries were more likely to develop infections due to microvascular damage and delayed wound healing. The results further support the evidence that perioperative glycemic control plays a crucial role in reducing SSIs in diabetic surgical patients.

Another significant observation was the prolonged hospital stay in diabetic patients (3.8 ± 1.2 days) compared to non-diabetics (2.9 ± 0.9 days, p=0.02). This aligns with the study by Yousuf et al. (13), which demonstrated that diabetic patients required extended hospitalization due to slower recovery, higher postoperative pain scores, and increased need for wound care interventions. In a large cohort study by Tariq et al. (14), diabetic patients had 1.5 times longer hospital stays than non-diabetics following LC, reinforcing our findings that diabetes delays postoperative recovery. The prolonged hospital stay in diabetic patients is likely attributed to increased inflammation, altered metabolic responses, and higher incidence of minor postoperative complications.

In terms of intraoperative findings, our study revealed that diabetic patients had significantly longer operative times (48.6 ± 10.2 minutes vs. 42.3 ± 9.5 minutes, p=0.01) and increased intraoperative blood loss. These findings are in line with those reported by Hussain et al. (15), who found that diabetic patients undergoing LC had longer surgical durations due to increased adhesions, inflamed gallbladders, and difficulty in dissection. Additionally, Rehman et al. (16) observed that diabetes contributes to subclinical chronic inflammation, increasing the complexity of laparoscopic procedures. Our findings reinforce the need for careful preoperative planning and intraoperative strategies to minimize operative time in diabetic patients.

Postoperative complications, including bile leakage (6.7% vs. 2.2%) and postoperative bleeding (11.1% vs. 4.4%), were higher in diabetic patients, though not statistically significant. These complications have been previously documented in studies, including one by Ullah et al. (17), who reported that poor metabolic control and hyperglycemia can exacerbate intra-abdominal inflammation, increasing the risk of bile duct injury and hemorrhagic complications. However, the overall incidence of bile leakage and bleeding remains relatively low in both diabetic and non-diabetic patients, reflecting the safety and feasibility of LC even in high-risk populations.

Readmission rates within 30 days were significantly higher among diabetic patients (15.6%) compared to non-diabetics (4.4%, p=0.03). These findings are consistent with Bukhari et al. (18), who noted that diabetic patients had a two-fold increased risk of readmission due to complications such as SSIs, delayed wound healing, and poor pain management. Early postoperative follow-up and targeted interventions, such as optimizing glycemic control and monitoring for wound infections, could potentially reduce readmission rates among diabetic individuals.

A notable outcome in our study was the delayed return to normal activities in diabetic patients (10.5 ± 2.4 days vs. 7.9 ± 2.1 days, p=0.01). This finding is in accordance with previous studies, including one by Basit et al. (19), which highlighted that diabetic patients experience prolonged post-surgical fatigue, delayed wound healing, and extended recovery times. Additionally, factors such as persistent pain and metabolic stress response contribute to delayed rehabilitation in diabetic individuals, emphasizing the need for enhanced postoperative support and rehabilitation strategies for this patient group.

While this study provides valuable insights into the impact of diabetes on LC outcomes in Pakistan, certain limitations must be acknowledged. The study was conducted at a single tertiary care center, which may limit the generalizability of the findings to other populations. Additionally, we did not stratify diabetic patients based on glycemic control, which could have provided further insight into the relationship between HbA1c levels and postoperative complications. Future multicenter studies with larger sample sizes and long-term follow-up are recommended to further elucidate the role of perioperative glucose control in improving surgical outcomes.

Conclusion

This study confirms that diabetic patients undergoing LC are at a higher risk of prolonged operative time, increased SSIs, longer hospital stays, delayed recovery, and higher readmission rates compared to non-diabetic individuals. These findings reinforce the importance of preoperative glycemic optimization, meticulous intraoperative techniques, and stringent postoperative monitoring to improve surgical outcomes in

diabetic individuals. Given the rising prevalence of diabetes in Pakistan, targeted strategies to reduce perioperative complications in diabetic patients undergoing LC should be prioritized in clinical practice.

Declarations

Data Availability statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department concerned. (IRBEC-A/28/ERC/147/24)
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Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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Review of Literature, Data entry, Data analysis, and drafting article.

All authors reviewed the results and approved the final version of the manuscript. They are also accountable for the integrity of the study.

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