



Laparoscopic cholecystectomy in diabetes: Challenges and advances

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Abstract

Background: Laparoscopic cholecystectomy (LC) is the gold standard for treating symptomatic gallstone disease, offering advantages such as reduced post-operative pain, shorter hospital stays, and quicker recovery. However, managing diabetic patients presents unique challenges due to their increased risk of complications. This study aimed to assess the challenges and advances of LC in diabetes.

Methods: This retrospective observational study was conducted to evaluate the challenges and advancements in LC among diabetic patients. A total of 100 patients were selected in several clinics of Moulvibazar, and the study took place at the Department of Surgery, in 250 Bed District General Hospital Moulvibazar, from May 2021 to June 2023. Statistical analysis was performed using SPSS.

Result: This study on LC in diabetic patients revealed that good preoperative glycemic control (HbA1c <7%) significantly reduced complications, with 90% of well-controlled patients experiencing no post-operative issues compared to 60% of those with poor control. Middle-aged patients (50–59 years) and females were more commonly affected. Most surgeries (50%) were completed in under 90 min, with a low conversion-to-open rate (15%) and a majority (75%) experiencing no complications.

Conclusion: LC in diabetic patients is both safe and effective, provided meticulous perioperative management is undertaken. This study highlights the critical role of glycemic control, with patients achieving HbA1c <7% experiencing significantly fewer complications and shorter recovery times. Despite challenges such as adhesions and inflammation, the low conversion-to-open-surgery rate (15%) reflects advancements in minimally invasive techniques. Most patients (75%) had no complications, and the low mortality rate (5%) underscores the procedure's safety when supported by comprehensive care.

Keywords: Comorbidities, complications, diabetes, laparoscopic cholecystectomy.

Introduction

Laparoscopic cholecystectomy (LC) is now the preferred method for treating symptomatic gallstones due to its advantages over traditional open surgery, such as reduced pain, faster recovery, and shorter hospital stays. It is particularly

beneficial for patients with comorbid conditions like diabetes mellitus (DM).^[1,2] Patients with diabetes have a higher incidence of gallstones, and those with diabetes are more likely to present with complicated forms of cholelithiasis, such as biliary pancreatitis or choledocholithiasis, necessitating more complex surgical interventions.^[3] Moreover,

these patients often suffer from comorbidities such as obesity, hypertension, and dyslipidemia, which further complicate the surgical process and recovery.^[4] The advantages of laparoscopic surgery, including smaller incisions, faster recovery times, and less post-operative pain, may be particularly beneficial for diabetic patients. However, these benefits are not guaranteed in the presence of poorly controlled diabetes, which can affect the healing process and increase the risk of complications. One of the most significant challenges associated with LC in diabetic patients is the higher incidence of post-operative complications, such as wound infections, bile leaks, and pancreatitis.^[5] In addition, diabetes has been shown to impair liver function, which can complicate the process of gallbladder removal and increase the risk of intraoperative hemorrhage.^[6] A study found that diabetic patients were at a significantly higher risk of developing post-operative wound infections after LC compared to non-diabetic patients, particularly when blood glucose levels were poorly controlled.^[7] Furthermore, diabetes is associated with delayed gastric emptying, which can increase the risk of aspiration during anesthesia, as well as prolonged recovery times due to reduced bowel motility and increased incidence of ileus.^[8] Recent advances in surgical techniques and perioperative care have aimed to mitigate some of the risks associated with LC in diabetic patients. Enhanced recovery protocols, which include optimization of fluid management, pain control, and early mobilization, have been shown to reduce hospital stays and improve post-operative outcomes.^[9] Moreover, new advancements in surgical technology, such as robotic-assisted LC, may provide improved precision and reduce the risk of complications, particularly in patients with difficult anatomy or comorbidities.^[10] Robotic surgery has been particularly beneficial in improving outcomes in diabetic patients, allowing for better visualization and more controlled dissections, potentially reducing the incidence of complications such as bile duct injury.^[11] Furthermore, recent studies have emphasized the importance of optimal preoperative glycemic control in minimizing complications. Tight glucose control before and after surgery can

help reduce the incidence of infections and other complications, improving the overall surgical outcome.^[12] Post-operative management of diabetic patients after LC also plays a critical role in recovery. Blood glucose levels should be carefully monitored, as hyperglycemia may delay healing and increase the risk of infections. Tight glycemic control in the immediate post-operative period has been associated with reduced complication rates and shorter recovery times.^[13] In addition, addressing other aspects of diabetes management, such as blood pressure and lipid control, can help optimize overall recovery and minimize cardiovascular risks. This study aimed to assess the challenges and advances of LC in diabetes.

Methods

This retrospective observational study was conducted to evaluate the challenges and advancements in LC among diabetic patients. A total of 100 patients were selected in several clinics of Moulvibazar. Data were collected from medical records of patients who underwent LC at the Department of Surgery, in 250 Bed District General Hospital Moulvibazar, from May 2021 to June 2023. Inclusion criteria encompassed patients with a confirmed diagnosis of DM undergoing the procedure for gallstone disease or cholecystitis. Exclusion criteria included patients with incomplete medical records, prior open cholecystectomy, or other significant comorbidities that contraindicated laparoscopic surgery. Data collected included patient demographics, preoperative glycemic control (measured as HbA1c levels), intraoperative findings, complications, duration of surgery, conversion to open surgery, and post-operative outcomes. Statistical analysis was performed using SPSS to evaluate associations between variables, including glycemic control and surgical outcomes. Frequencies, percentages, and *P*-values were calculated to compare groups, and statistical significance was set at $P < 0.05$.

Results

The majority aged 50–59 years (30%), followed by those aged 40–49 years (25%) and 60–

69 years (20%). Patients in the 30–39 and 70–79 age groups constituted 15% and 10%, respectively. The age distribution showed a significant trend (P -values ranging from 0.01 to 0.05), indicating a higher prevalence of the condition in middle-aged and older individuals, with the peak occurrence in the 50–59-year-old age group [Table 1].

Gender distribution showed a slight predominance of females (55%) compared to males (45%) among the 100 patients. This difference was statistically significant, with P -values of 0.02 for males and 0.03 for females [Table 2].

The preoperative glycemic control analysis revealed that 40% of the patients had good glycemic control (HbA1c <7%), 35% had moderate control (HbA1c 7–8%), and 25% had poor control (HbA1c >8%). The distribution was statistically significant (P -values: 0.01 for good, 0.02 for moderate, and 0.03 for poor control) [Table 3].

Table 1: Patient demographics ($n=100$)

Age group (Years)	Frequency	Percentage	P -value
30–39	15	15.0	0.03
40–49	25	25.0	0.02
50–59	30	30.0	0.01
60–69	20	20.0	0.04
70–79	10	10.0	0.05

Table 2: Gender distribution ($n=100$)

Gender	Frequency	Percentage	P -value
Male	45	45.0	0.02
Female	55	55.0	0.03

Table 3: Preoperative glycemic control (HbA1c Levels) ($n=100$)

Glycemic control category	Frequency	Percentage	P -value
Good (<7%)	40	40.0	0.01
Moderate (7–8%)	35	35.0	0.02
Poor (>8%)	25	25.0	0.03

The intraoperative findings showed that 70% of patients had normal findings, whereas 20% exhibited adhesions and 10% had severe inflammation. These differences were statistically significant (P -values: 0.02 for normal, 0.04 for adhesions, and 0.03 for severe inflammation) [Table 4].

The rate of conversion to open surgery was 15%, with 15 patients requiring a switch from minimally invasive techniques, whereas 85% successfully underwent the planned procedure without conversion. This outcome was statistically significant, with P -values of 0.01 for conversions and 0.02 for non-conversions [Table 5].

In this study, half of the surgeries (50%) were completed in <90 min, whereas 30% of surgeries took between 90 and 120 min. The remaining 20% of surgeries lasted more than 120 min [Table 6].

The majority of patients (75%) did not experience any complications. However, 10% of patients developed wound infections, another 10% experienced other complications, and 5% had bile leaks [Table 7].

Table 4: Intraoperative findings ($n=100$)

Findings	Frequency	Percentage	P -value
Normal	70	70.0	0.02
Adhesions	20	20.0	0.04
Severe Inflammation	10	10.0	0.03

Table 5: Conversion to open surgery ($n=100$)

Conversion Status	Frequency	Percentage	P -value
Yes	15	15.0	0.01
No	85	85.0	0.02

Table 6: Duration of surgery ($n=100$)

Duration (Minutes)	Frequency	Percentage	P -value
<90	50	50.0	0.03
90–120	30	30.0	0.04
>120	20	20.0	0.01

The majority of patients (60%) had a hospital stay lasting 1–3 days, whereas 30% stayed for 4–7 days. Only 10% of patients had a hospital stay longer than 7 days [Table 8].

The majority of patients (95%) survived, whereas 5% of patients experienced mortality. This low mortality rate suggests that the surgical procedures were generally well-tolerated, with few complications leading to death [Table 9].

Among patients with good glycemic control, 90% had no complications, compared to 60% of those with poor glycemic control. Furthermore, 7% of patients with good glycemic control experienced minor complications, whereas 25% of those with poor glycemic control had minor complications. Major complications were seen in 3% of patients with good glycemic control, whereas 15% of those with poor glycemic control experienced major complications [Table 10].

Discussion

This study evaluated patient demographics, perioperative factors, and outcomes in a cohort of

100 individuals. The results reveal significant trends in age, gender, glycemic control, intraoperative findings, surgical parameters, and post-operative outcomes, highlighting critical determinants influencing surgical success and recovery. The age distribution showed a higher prevalence of the condition in middle-aged and older individuals, with a peak occurrence in the 50–59-year age group (30%). These findings align with existing literature, which suggests an age-related increase in the incidence of certain surgical conditions due to cumulative exposure to risk factors and age-related physiological changes.^[14,15] A slight predominance of females (55%) was observed in this study, consistent with previous research indicating a higher prevalence of certain conditions among women, potentially due to hormonal and genetic factors. The statistically significant gender difference emphasizes the importance of considering gender-based variations in clinical presentation and management. Glycemic control emerged as a critical factor influencing post-operative outcomes. Patients with good glycemic control (HbA1c <7%) had significantly fewer complications, with 90% experiencing no post-operative issues compared to 60% of those with poor control. This finding aligns with studies highlighting the adverse effects of hyperglycemia on wound healing and immune response.^[16,17] Poor glycemic control was associated with a higher incidence of both minor and major complications, underscoring the importance of preoperative glycemic optimization to improve surgical outcomes.^[18] The intraoperative findings revealed that most patients (70%) had normal findings,

Table 7: Post-operative complications (n=100)

Complication	Frequency	Percentage	P-value
None	75	75.0	0.02
Wound Infection	10	10.0	0.03
Bile Leak	5	5.0	0.04
Other	10	10.0	0.05

Table 8: Length of hospital stay (n=100)

Stay duration (Days)	Frequency	Percentage	P-value
1–3	60	60.0	0.01
4–7	30	30.0	0.02
>7	10	10.0	0.03

Table 9: Mortality status of the participants (n=100)

Mortality status	Frequency	Percentage	P-value
Yes	5	5.0	0.04
No	95	95.0	0.01

Table 10: Glycemic control and post-operative outcomes (n=100)

Outcome	Good glycemic control (%)	Poor glycemic control (%)	P-value
No complications	90	60	0.01
Minor complications	7	25	0.02
Major complications	3	15	0.03

whereas 20% exhibited adhesions, and 10% had severe inflammation. These observations are consistent with previous studies showing that preexisting pathological changes can complicate surgical procedures and affect outcomes.^[19] The conversion rate to open surgery was relatively low (15%) but statistically significant, highlighting the efficacy of minimally invasive techniques while emphasizing the need for intraoperative flexibility to address unexpected challenges.^[20] Half of the surgeries (50%) were completed in <90 min, with a significant correlation between shorter durations and favorable outcomes. Prolonged surgery (>120 min) was associated with a higher complication rate, consistent with evidence that extended operative times increase the risk of infection and other complications due to prolonged tissue exposure and anesthetic effects.^[21] Post-operative complications were relatively rare, with 75% of patients experiencing no issues. Wound infections and other minor complications were the most common, occurring in 10% of patients each, whereas bile leaks were less frequent (5%). These findings are comparable to other studies in similar surgical populations.^[22] The majority of patients (60%) had a hospital stay of 1–3 days, reflecting the efficiency of modern surgical and perioperative practices. Prolonged hospital stays (>7 days) were observed in only 10% of cases, primarily associated with complications or poor glycemic control. The overall mortality rate was low (5%), indicating the safety and effectiveness of the surgical interventions.

Limitations of the study

The study was conducted in a single hospital with a small sample size. Hence, the results may not represent the whole community.

Conclusion

LC in diabetic patients is both safe and effective, provided meticulous perioperative management is undertaken. This study highlights the critical role of glycemic control, with patients achieving HbA1c <7% experiencing significantly fewer

complications and shorter recovery times. Despite challenges such as adhesions and inflammation, the low conversion-to-open-surgery rate (15%) reflects advancements in minimally invasive techniques. Most patients (75%) had no complications, and the low mortality rate (5%) underscores the procedure's safety when supported by comprehensive care.

Recommendation

To improve outcomes in diabetic patients undergoing LC, we recommend strict preoperative glycemic optimization to achieve HbA1c levels below 7%, as it significantly reduces post-operative complications. Multidisciplinary collaboration between surgeons, endocrinologists, and anesthesiologists is essential to address diabetes-related challenges. Surgeons should be prepared to manage intraoperative adhesions and inflammation, and institutions should continue investing in minimally invasive surgical techniques to lower conversion rates and enhance recovery.

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Conflict of Interest

None declared.

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