



Incidence of Surgical Site Infections in Diabetic and Non-Diabetic Patients Undergoing Laparoscopic Cholecystectomy

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Received: August 01, 2025

Accepted: September 27, 2025

Published: October 02, 2025

Cite this article as: A, M, M, Etbiga., W, Gadora., H, Fathi (2025). Incidence of Surgical Site Infections in Diabetic and Non-Diabetic Patients Undergoing Laparoscopic Cholecystectomy. Libyan Journal of Medical and Applied Sciences (LJMAS). 2025;3(4):01-05.

Abstract:

Background: This study aimed to compare the frequency of surgical site infections (SSIs) between patients with type II diabetes and non-diabetic patients undergoing laparoscopic cholecystectomy.

Study Design: Place and Duration of Study: Conducted at Sirte Oncology Center and a private clinic in Sirte, Libya, from February 2024 to February 2025.

Methods: A total of 116 patients undergoing laparoscopic cholecystectomy were included and divided into two equal groups of 58 patients each. Group A consisted of non-diabetic individuals, while Group B included patients with type II diabetes mellitus. Postoperative follow-up was carried out for up to three weeks to monitor for the development of SSIs. The proportions of patients developing SSIs in each group were compared using the chi-square test, with statistical significance set at $p < 0.05$.

Results: In Group A, 37 patients were older than 40 years, whereas in Group B, 35 patients were older than 40 years. Surgical site infections occurred in 3 patients (5.1%) in Group A and in 5 patients (8.6%) in Group B. The difference between the groups was not statistically significant ($p = 0.464$).

Conclusion: The presence of type II diabetes mellitus was not found to significantly influence the risk of surgical site infection following laparoscopic cholecystectomy.

Keywords: Laparoscopic Cholecystectomy, Cholelithiasis, Diabetes Mellitus, Surgical Site Infection.

معدل حدوث العدوى في موضع الجراحة بين المرضى المصابين وغير المصابين بداء السكري الخاضعين لاستئصال المرارة بالمنظار

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الملخص

الخلفية: هدفت هذه الدراسة إلى مقارنة معدل حدوث العدوى في موضع الجراحة بين المرضى المصابين بداء السكري من النوع الثاني والمرضى غير المصابين به ممن يخضعون لاستئصال المرارة بالمنظار.

تصميم الدراسة: مكان وفترة الدراسة: أجريت الدراسة في مركز سرت للأورام وعيادة خاصة في مدينة سرت، ليبيا، خلال الفترة من فبراير 2024 إلى فبراير 2025.

الطرق: شملت الدراسة 116 مريضاً خضعوا لعملية استئصال المرارة بالمنظار، وتم تقسيمهم بالتساوي إلى مجموعتين؛ المجموعة (أ) تضم 58 مريضاً غير مصابين بالسكري، والمجموعة (ب) تضم 58 مريضاً مصاباً بداء السكري من النوع الثاني. تم متابعة المرضى بعد العملية لمدة ثلاثة أسابيع لرصد حدوث العدوى في موضع الجراحة. تمت مقارنة نسب الإصابة بين المجموعتين باستخدام اختبار مربع كاي، مع اعتبار قيمة $p < 0.05$ ذات دلالة إحصائية.

النتائج: كان 37 مريضاً في المجموعة (أ) و 35 مريضاً في المجموعة (ب) أكبر من 40 عاماً. ظهرت العدوى في موضع الجراحة لدى 3 مرضى (5.1%) في المجموعة (أ)، ولدى 5 مرضى (8.6%) في المجموعة (ب) لم يكن الفرق بين المجموعتين ذا دلالة إحصائية ($p = 0.464$).
الاستنتاج: لم يظهر أن الإصابة بداء السكري من النوع الثاني تؤثر بشكل ملحوظ على خطر الإصابة بالعدوى في موضع الجراحة بعد استئصال المرارة بالمنظار.

الكلمات المفتاحية: استئصال المرارة بالمنظار، تحص صفاوي، داء السكري من النوع الثاني، العدوى في موضع الجراحة.

Introduction

Laparoscopic cholecystectomy has become the standard and most widely accepted approach for the management of symptomatic gallbladder disease [1]. This minimally invasive technique has significantly reduced postoperative pain, leading to shorter hospital stays and faster recovery, allowing patients to return to their normal daily activities and work sooner [2]. Compared to open surgery, laparoscopic procedures offer clear advantages in terms of reduced surgical trauma, especially in healthy individuals [1].

Type II diabetes mellitus is a chronic metabolic disorder frequently associated with microvascular and macrovascular complications, as well as neuropathic disorders. Poor glycemic control can impair immune function and wound healing, making diabetic patients more susceptible to postoperative infections, particularly following open surgical interventions [3]. Diabetes is also considered a risk factor for conversion from laparoscopic to open surgery and is associated with increased morbidity when compared to non-diabetic patients undergoing similar procedures [4].

Given the reduced incision size, shorter operative and anesthesia durations, minimal tissue manipulation, and decreased postoperative immobility associated with laparoscopic surgery, it is hypothesized that the incidence of surgical site infections (SSIs) among diabetic patients undergoing this procedure may be substantially lower than in open surgery. This potential benefit warrants further investigation.

Despite the widespread use of laparoscopic cholecystectomy, there is limited prospective research directly comparing outcomes between diabetic and non-diabetic patients. Most previous studies have been retrospective and observational, often reporting conflicting results. Therefore, this study was designed as a prospective cohort study to compare the frequency of SSIs after laparoscopic cholecystectomy in patients with type II diabetes versus non-diabetic patients. The primary objective was to determine whether diabetes contributes to increased postoperative morbidity in this context and to evaluate the overall safety and efficacy of laparoscopic cholecystectomy in diabetic individuals.

Materials and Methods

This prospective cohort study was conducted at Sirte Oncology Center and a private clinic in Sirte, Libya, from February 2024 to February 2025. A total of 116 patients scheduled for elective laparoscopic cholecystectomy were enrolled and equally divided into two groups: Group A (non-diabetic, $n=58$) and Group B (type II diabetic, $n=58$).

The sample size was calculated using standard statistical methods with 80% power and a 5% level of significance. The expected SSI rate for the diabetic group (14.29%) was based on findings from Akram et al. (2009), while the expected rate for the non-diabetic group (1.7%) was derived from Chuang et al. (2004), which reported low SSI incidence in non-diabetic patients following laparoscopic cholecystectomy. For comparative context, Ismat et al. (2016) documented SSI rates of 11.67% and 6.67% in diabetic and non-diabetic patients, respectively.

Inclusion Criteria: Male and female patients over 20 years of age with symptomatic cholelithiasis, classified as ASA I (non-diabetic) or ASA II (type II diabetic) according to the American Society of Anesthesiologists and WHO criteria.

Exclusion Criteria: History of previous abdominal surgery, contraindications to general anesthesia, recent acute cholecystitis (within the past 4 weeks), or significant comorbidities other than diabetes.

All participants provided written informed consent. Diabetic patients in Group B were required to have good glycemic control, with a fasting blood glucose level below 129 mg/dL on the day of surgery. All procedures were performed by consultant surgeons under general anesthesia, adhering to strict aseptic techniques.

A single prophylactic dose of intravenous ceftriaxone (1 g) was administered at induction, followed by one or two additional doses postoperatively as per institutional protocol.

Definition of Surgical Site Infection (SSI): SSI was defined as the presence of purulent discharge from the surgical site, accompanied by signs of infection such as erythema, edema, pain, or fever. Superficial SSI involved the skin and subcutaneous tissue, while deep SSI affected the fascial or muscular layers. Intra-abdominal collection was defined as the presence of infective fluid in the abdominal cavity, detected clinically or via ultrasonography within three weeks postoperatively.

Patients were followed up during hospitalization and at one- and three-weeks post-surgery to monitor for SSI development. Data were collected using a standardized proforma and analyzed using SPSS software (version

1.6.2). Numerical data were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages. The chi-square test was used to compare infection rates between groups, with a p -value of ≤ 0.05 considered statistically significant.

Results

A total of 116 patients were enrolled, with 58 in each group. Of these, 92 (79.3%) were female and 24 (20.7%) were male. In Group A (non-diabetic), 47 (81%) were female and 11 (19%) were male. In Group B (diabetic), 45 (77.5%) were female and 13 (22.5%) were male.

Regarding age, 37 patients (63.8%) in Group A and 35 patients (60.3%) in Group B were over 40 years old (Table 1).

In Group A, 2 patients (3.4%) developed superficial SSI during hospitalization, and 1 patient (1.7%) developed deep SSI identified at the one-week follow-up. No intra-abdominal collections were observed.

In Group B, 3 patients (5.1%) developed superficial SSI during hospitalization, and 2 patients (3.4%) developed deep SSI identified at follow-up. No intra-abdominal collections occurred.

Overall, 3 patients (5.1%) in Group A and 5 patients (8.6%) in Group B developed SSI. The difference between the two groups was not statistically significant ($p = 0.464$) (Table 2).

Table 1. Demographic characteristics of patients

Characteristic	Group A (Non-diabetic) (n=58)	Group B (Diabetic) (n=58)	Total (n=116)
Age > 40 years	37 (63.8%)	35 (60.3%)	72 (62.1%)
Age $\leq$ 40 years	21 (36.2%)	23 (39.7%)	44 (37.9%)
Female	47 (81%)	45 (77.5%)	92 (79.3%)
Male	11 (19%)	13 (22.5%)	24 (20.7%)

Table 2. Incidence of surgical site infection (SSI)

SSI	Group A (Non-diabetic) (n=58)	Group B (Diabetic) (n=58)	p-value
Superficial SSI	2 (3.4%)	3 (5.1%)	
Deep SSI	1 (1.7%)	2 (3.4%)	
Total SSI	3 (5.1%)	5 (8.6%)	0.464

Discussion

Patients with diabetes mellitus are generally at an increased risk for postoperative complications, including surgical site infections [5,6,7], due to impaired immune responses and delayed wound healing [8,9,10,11]. This elevated risk is particularly evident in open surgical procedures, where larger incisions and greater tissue trauma contribute to higher morbidity [12].

In the context of open cholecystectomy, multiple studies have documented a higher incidence of SSIs in diabetic patients compared to non-diabetic individuals [12]. However, laparoscopic cholecystectomy, with its inherent advantages of minimal surgical trauma, smaller incisions, and reduced tissue handling, has been shown to lower the overall rate of postoperative wound infections in the general population [13,14]. These benefits suggest that the minimally invasive approach may help mitigate the increased risk typically associated with diabetes.

In the present study, the SSI rate was 8.6% in diabetic patients (Group B) compared to 5.1% in non-diabetic patients (Group A). Although the rate was higher in the diabetic group, the difference was not statistically significant ($p = 0.464$). This finding indicates that, in the setting of laparoscopic surgery, diabetes does not appear to be a major independent risk factor for SSI.

These results are consistent with previous research. Ismat et al. (2016) reported SSI rates of 11.67% and 6.67% in diabetic and non-diabetic patients, respectively, with no statistically significant difference ($p = 0.07$) [15]. Similarly, Akram et al. (2009) found an SSI rate of 14.29% in diabetic patients undergoing laparoscopic cholecystectomy in a local cohort [16]. Al-Mulhim (2010), in a large prospective study of 986 patients, also concluded that there was no significant difference in surgical outcomes between diabetic and non-diabetic patients undergoing laparoscopic procedures [17].

A key strength of the current study is its prospective design, which reduces recall bias and enhances data reliability. Unlike many prior studies that were retrospective, this research focused specifically on SSI as the primary outcome, providing a clearer assessment of the impact of diabetes on postoperative infection rates.

The findings suggest that the advantages of laparoscopic surgery such as reduced incision size, shorter operative time, minimal tissue manipulation, and earlier patient mobilization collectively counterbalance the physiological challenges posed by diabetes. As a result, diabetic patients can undergo laparoscopic cholecystectomy with a safety profile comparable to that of non-diabetic patients.

Therefore, laparoscopic cholecystectomy represents a safe and effective surgical option for patients with type II diabetes, offering outcomes that are not significantly different from those in non-diabetic individuals.

Discussion

The results of this study indicate that while diabetic patients are at a higher risk of surgical site infections following open surgery, laparoscopic cholecystectomy does not lead to a significant increase in postoperative morbidity in this population compared to non-diabetic patients. This is likely attributable to the numerous advantages of the laparoscopic approach, including smaller incisions, reduced tissue trauma, shorter anesthesia and operative times, and decreased postoperative immobility. These factors collectively lower the risk of infection and promote faster, safer recovery. Hence, laparoscopic cholecystectomy is a safe and effective procedure for managing gallbladder disease in patients with type II diabetes mellitus.

Conclusion

The results of this study indicate that while diabetic patients are at a higher risk of surgical site infections following open surgery, laparoscopic cholecystectomy does not lead to a significant increase in postoperative morbidity in this population compared to non-diabetic patients. This is likely attributable to the numerous advantages of the laparoscopic approach, including smaller incisions, reduced tissue trauma, shorter anesthesia and operative times, and decreased postoperative immobility. These factors collectively lower the risk of infection and promote faster, safer recovery. Hence, laparoscopic cholecystectomy is a safe and effective procedure for managing gallbladder disease in patients with type II diabetes mellitus.

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