

COMPARISON OF SURGICAL SITE INFECTION BETWEEN DIABETIC AND NON-DIABETIC PATIENTS IN CLEAN SURGICAL PROCEDURES

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(Received, 27th January 2024, Revised 24th March 2024, Published 12th April 2024)

Abstract: Surgical site infections (SSIs) are a major concern in healthcare, especially for individuals with diabetes. Diabetes can impair wound healing and weaken the immune system, increasing the risk of SSIs. Studying SSIs in diabetic versus non-diabetic patients undergoing clean surgeries is vital for improving patient care. **Objective:** The primary objective of this study was to investigate the incidence of surgical site infections (SSIs) in individuals with diabetes compared to those without diabetes who underwent clean surgical procedures. **Methods:** After the ethical approval from the institutional review board, this comparative study was conducted at Combined Military Hospital Jhelum from July 2022 to December 2023. A consisted of people with diabetes (n=50), while Group B comprised patients who did not have diabetes (n=50). All patients were administered suitable antibiotics before surgery. Each patient received a singular intravenous dose of Ceftriaxone 1g, administered thirty minutes before initiating the initial incision. The patients were monitored for surgical site infections (SSI), defined as the presence of redness, fever, tenderness at the incision site, discharge from the surgical wound, or the development of an abscess within 28 days after surgery. **Results:** Most participants in both study groups underwent open ventral hernia repair procedures, 54% in group A and 58% in group B. Mean \pm S. D of the Hb1Ac levels of the participants in both groups was 8.46 ± 1.16 and 4.14 ± 1.01 ($P < 0.0001$). 58% of participants in Group A, while 22% in Group B had surgery-associated complications ($p < 0.0001$). 30% of participants in Group A, while 10% in Group B had SSI ($p < 0.0001$). **Conclusion:** Individuals with diabetes are more susceptible to experiencing higher rates of surgical site infection, especially in cases of procedures that are considered clean, in comparison to individuals without diabetes.

Keywords: SSI, Diabetes, Laparoscopic, Hernia

Introduction

Surgical site infections (SSIs) continue to be a prevalent and significant consequence following surgical procedures, ranking as the second most prevalent healthcare-associated illness (1). Patients who develop SSIs have a notable rise in their duration of hospitalisation, healthcare costs, and the likelihood of mortality as compared to patients who do not develop SSIs. The prevention of SSIs necessitates the incorporation of various perioperative interventions (2). It has been observed that roughly 50% of SSIs can be averted using evidence-based preventive approaches. In 2019, it was estimated that approximately 463 million individuals were affected by diabetes mellitus. The majority, exceeding 70%, were located in developing nations such as Pakistan (3). In Pakistan specifically, the prevalence of diabetes has experienced a significant increase of 14.8% since 2017, now affecting 17.1% of the population. It is anticipated that these figures will experience an upward trend due to the projected growth in the global diabetes population, estimated to elevate from 2.8% in the year 2000 to 4.4% by 2030 (4). Individuals affected by this condition experience a notable reduction in their life expectancy, estimated to be around nine years. Additionally, they have an increased likelihood of developing issues related to the cardiovascular and cerebrovascular systems, as well as cancers and metabolic diseases. Allegedly, around 50% of individuals who have

diabetes necessitate at least one surgical procedure throughout their lifespan. This is a matter of concern due to their heightened susceptibility to post-operative complications, such as delayed wound healing, surgical site infections (SSIs), the need for surgical revision or blood transfusion, and prolonged hospitalisation (5, 6). There exists a correlation between inadequately managed type II diabetes and a variety of problems, including microvascular, macrovascular, and neuropathic manifestations. There is a notable correlation between diabetes and a heightened incidence of wound infection after open surgical interventions (7). It is also hypothesised to contribute to the transition to an open, laparoscopic technique. It is believed to be correlated with heightened morbidity in comparison to non-diabetic patients undergoing the identical procedure (8). Diabetes mellitus is recognised as a contributory factor that heightens the susceptibility of surgical patients to postoperative infections. Given the significant reduction in various factors such as incision size, operative time, anaesthesia duration, tissue handling and dissection, hospital stay, and postoperative immobility associated with laparoscopic surgery, it is reasonable to hypothesise that the infection rate among diabetic patients undergoing this surgical approach would be substantially decreased (9). Nevertheless, there is a scarcity of research examining the results of laparoscopic cholecystectomy in diabetic

[Citation: Raja, R.A., Abbasi, M.H., Taj, M.R.U., Talha, Qayyum, T. (2024). Comparison of surgical site infection between diabetic and non-diabetic patients in clean surgical procedures. *Biol. Clin. Sci. Res. J.*, 2024: 805. doi: <https://doi.org/10.54112/bcsrj.v2024i1.805>]

individuals in comparison to those without diabetes. Most prior investigations consist of retrospective observational studies, which have yielded inconsistent findings. The repair of ventral hernias is a commonly done surgical treatment that is conducted on a global scale. Specifically, the United States and the European Union collectively contribute to many cases yearly, with roughly 400,000 and 300,000 instances, respectively (10). The surgery in question is commonly associated with an elevated incidence of post-operative wound infection. Theoretically, the coexistence of a surgical procedure with susceptibility to infection and the presence of diabetes mellitus should elevate the overall likelihood of developing an SSI (11). However, the existing literature presents conflicting findings since the association between these factors is relatively challenging to anticipate. Haemoglobin A1c levels serve as a conventional metric for assessing the extent of glycemic regulation over 90 days (12). Elevated peri-operative levels of HbA1c have the potential to serve as an indicator of the likelihood of developing SSIs (13). Both diabetes mellitus and surgical correction of ventral hernias are prevalent conditions in Pakistan. The primary objective of this study was to investigate the incidence of various complications, such as surgical site infections (SSIs), seroma formation, and hematoma formation, in individuals with diabetes compared to those without diabetes who underwent clean surgical procedures.

Methodology

After the ethical approval from the institutional review board, this comparative study was conducted at Combined Military Hospital Jhelum from July 2022 to December 2023. The prevalence of SSI is 3%; using the WHO EPI sample size calculator, considering a 95% confidence interval and a 5% margin of error, a sample size of 100 participants was obtained. Through non-probability consecutive sampling, patients between ages 20-65 years, of either gender, either diabetic or non-diabetic, and undergoing either elective open laparoscopic or ventral hernia repair surgery were included in the present study. Patients with other abdominal surgeries, co-morbidities like hypertension, heart problems, or any contradiction to general anaesthesia were excluded from the present study. Group A consisted of people with diabetes (n=50), while Group B comprised patients who did not have diabetes (n=50). All patients were administered suitable antibiotics before surgery. Each patient received a singular intravenous dose of Ceftriaxone 1g, administered thirty minutes before initiating the initial incision. A proline mesh was strategically placed utilising the sub-lay technique, ensuring

a 5cm overlap with the abdominal wall starting from the borders of the defect and, after that, fastened circumferentially. A peritoneal layer was employed beneath the mesh to prevent direct contact between the intestines and the mesh. All surgical procedures were performed under the administration of general anaesthesia. The patients underwent a surgical procedure and subsequently had a Radevac suction drain inserted. They were discharged on the third day after the surgery and received follow-up care as outpatients on the fourteenth and twenty-eighth days after the surgery. The suction drain was discontinued if the drainage output was below 20 ml within 24 hours. The patients were monitored for surgical site infections (SSI), defined as the presence of redness, fever, tenderness at the incision site, discharge from the surgical wound, or the development of an abscess within 28 days after surgery. The formation of seroma (accumulation of serous fluid) and hematoma (localised blood collection) was assessed. The data underwent analysis with the Statistical Package for the Social Sciences version 21.0. Quantitative factors, such as body mass index, age, duration of diabetes, and HbA1c levels, were assessed as Mean ± S. D. Categorical characteristics such as gender, hernia type, HbA1c group, and the occurrence of complications were recorded and reported as frequencies and percentages. The chi-square test was utilised to analyse qualitative variables. The independent sample t-test was utilised to analyse quantitative variables. A significance level of ≤0.05 was employed in our analysis.

Results

Table 1 shows the clinical and demographic parameters of the study participants in both groups. Mean± S. D of the age of the participants in both groups was 35.86±12.5 and 37.84±12.94 years (P=0.425). The study groups have the most female participants, 48% in group A and 40% in group B. Mean± S. D of the BMI of the participants in both groups was 27.22±3.63 and 26.5±3.32 kg/m²(P=0.316). Both the study groups have the majority of para-umbilical type of hernia, 44% in group A and 38% in group B. Table 2 shows the comparison of complications after the surgery in study groups. Most participants in both study groups underwent open ventral hernia repair procedures, 54% in group A and 58% in group B. Mean± S. D of the Hb1Ac levels of the participants in both groups was 8.46±1.16 and 4.14±1.01 (P=<0.0001). 58% of participants in Group A, while 22% in Group B had surgery-associated complications (p<0.0001). 30% of participants in Group A, while 10% in Group B had SSI (p<0.0001).

Table 1: Clinical and demographic parameters of the study participants in both groups

Parameters	Group A Diabetic group (n=50)	Group B Non-Diabetic group (n=50)	P-Value
Age (Years)	35.86±12.5	37.84±12.94	0.425
Gender			0.552
Male	24 (48%)	20 (40%)	
Female	26 (52%)	30 (40%)	
BMI Kg/m ²	27.22±3.63	26.5±3.32	0.316
Type of hernia			0.004

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Para-umbilical	22 (44%)	19 (38%)	
Epigastric	19 (38%)	17 (34%)	
Incisional	9 (18%)	14 (28%)	

Table 2: Comparison of complications after the surgery in study groups.

Parameters	Group A Diabetic group (n=50)	Group B Non-Diabetic group (n=50)	P-Value
Type of surgery			0.322
Open	27 (54%)	29 (58%)	
Laparoscopic	23 (46%)	21 (42%)	
HbA1c	8.46±1.16	4.14±1.01	<0.0001
Diabetes duration (years)	7.84±2.69	0±0	<0.0001
Complications	29 (58%)	11 (22%)	<0.0001
SSI	15 (30%)	5 (10%)	0.024
Seroma	9 (18%)	4 (8%)	0.024
Hematoma	5 (10%)	3 (6%)	0.485

Discussion

The study primarily consisted of female patients, and no significant association was observed between gender and the occurrence of complications or SSIs. Brahmbatt et al. conducted a study involving 201 patients, of which only 53 (26.4%) were female. This gender distribution is likely attributed to the study conducted in a Veterans Affairs hospital, where the patient population is predominantly male. The study's findings indicate no significant association between gender and the development of SSIs, as evidenced by a p-value of 0.16 (14). The average age of participants in both groups was 35.86±12.5 and 37.84±12.94 years (P=0.425). However, there was no statistically significant association between age and the development of surgical site infections (p=0.599). The study by Kaafarani et al. focused on an elderly population with an average age of 60.5±9.4 years. Despite the age difference, the researchers reached the same findings, as indicated by a p-value of 0.977 (15). It seems that the progression of age does not influence the occurrence of SSIs in the context of ventral hernia repair. The current study discovered no statistically significant correlation between increasing BMI and the occurrence of complications (p=0.316). This finding aligns with the research conducted by Kaafarani et al. (p=0.972) (15). Still, it contradicts the results of Won et al. (p=0.009) (16), Brahmbatt et al. (14), and Qin et al. (17), who observed a statistically significant association between higher BMIs and the development of complications. The observed variation in the prevalence of obesity between the two samples can be attributed to the higher overall occurrence of obesity in the general population of their sample compared to ours. This study showed that the presence of diabetes was associated with a significant increase in the occurrence of SSIs, with a p-value <0.0001. This conclusion is consistent with previous research conducted by Brahmbatt et al. (p=0.04) (14), Won et al. (p=0.044)(16), and Qin et al. (p<0.001) (17). Meanwhile, Kaafarani et al. found no significant association between the presence of diabetes mellitus and the occurrence of SSIs, with a p-value of 0.209 (15). The lack of consistency observed in this discrepancy could be attributed to variations in antibiotic procedures employed and differences in antimicrobial susceptibility patterns within the populations under investigation. Our study provided evidence of a significant link between diabetes and the increased occurrence of seroma formation (p <0.0001). This

contradicts the results reported by Brahmbatt et al., which found no significant correlation (p=0.92) (14). It was shown that there was a positive correlation between elevated HbA1c levels and the occurrence of SSIs (p <0.0001). Although this relationship has not been previously investigated in the context of ventral hernia repair, it has been examined in prior studies involving foot procedures, as evidenced by the research conducted by Cancienne et al. (p<0.001) (18). Both open and laparoscopic repair of ventral hernias are considered safe procedures, with a low incidence of significant consequences. Nevertheless, the presence of co-morbidities, such as diabetes mellitus, might heighten the likelihood of experiencing adverse outcomes, including the development of SSIs, which can provide challenges in terms of treatment. It is essential to conduct a comprehensive medical history and physical examination to assess the presence of diabetes mellitus and potential harm to target organs. Furthermore, it is crucial to maintain proper regulation of blood glucose levels during the perioperative phase to minimise problems. HbA1c values possess the capacity to offer a reliable and measurable approach for assessing the extent of glycemic control, so serving as an indicator of the likelihood of developing problems. Consequently, these levels can signal the necessity for more attentiveness in managing patients exhibiting such characteristics. The study primarily consisted of female patients, and the follow-up period was limited to one month. Additional study is necessary to investigate the subject matter using a more extensive and diverse sample. This is needed to establish the objective function of HbA1c levels in predicting problems and ascertain the long-term effects on morbidity, mortality, and recurrence rates associated with these treatments.

Conclusion

Individuals diagnosed with Diabetes Mellitus face an elevated susceptibility to the development of SSIs, even in surgical procedures characterised as clean, such as laparoscopic ventral hernia repair. Ensuring optimal management of blood glucose levels before, during, and after surgical procedures is of utmost importance to minimise this condition's occurrence.

Declarations

Data Availability statement

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All data generated or analyzed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC/CMHJ-21/02)

Consent for publication.

Approved

Funding

Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

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Study Design, Review of Literature.

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Conception of Study, Final approval of manuscript.

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Data entry and Data analysis, drafting article.

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