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Original research article

COMPARISON OF SURGICAL SITE INFECTIONS IN DIABETIC VERSUS NON-DIABETIC PATIENTS UNDERGOING CLEAN SURGICAL PROCEDURES AT A TERTIARY CARE HOSPITAL

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Abstract: *Surgical site infections (SSIs) are a common complication that can significantly impact recovery, particularly in patients with diabetes. Understanding the incidence of SSIs in diabetic versus non-diabetic patients undergoing clean surgical procedures is critical for improving postoperative outcomes.* ***Objective:*** *This study aims to compare the incidence of surgical site infections (SSIs) in diabetic and non-diabetic patients undergoing clean surgical procedures at a tertiary care hospital.* ***Methods:*** *An observational cohort study was conducted with 110 patients, divided into two groups: Group A (diabetic patients) and Group B (non-diabetic patients). All patients underwent clean surgeries, including hernia repair and laparoscopic cholecystectomy. Postoperative complications, including SSIs, wound dehiscence, and seroma formation, were assessed. Statistical analysis was performed to evaluate differences in complication rates between the two groups, with a significance level set at $p < 0.05$.* ***Results:*** *SSIs were observed in 10.9% of diabetic patients compared to 3.6% in non-diabetic patients, though this difference was not statistically significant ($P = 0.14$). Wound dehiscence occurred in 3.6% of diabetics versus 1.8% of non-diabetics ($P = 0.55$), while seroma formation was noted in 1.8% of diabetics, with no cases in the non-diabetic group ($P = 0.31$).* ***Conclusion:*** *The incidence of surgical site infections was higher in diabetic patients than in non-diabetic patients undergoing clean surgical procedures, though the difference was not statistically significant. Diabetic patients remain at an increased risk of postoperative complications, highlighting the need for enhanced perioperative care to mitigate infection risks.*

Keywords: Surgical Site Infections (SSIs), Diabetes, Complications.

Introduction

Although there have been impressive advancements in surgical techniques, prophylactic antibiotics, and improvements in the operating room environment and ergonomics, surgical site infections (SSIs) continue to be a major cause of patient morbidity and mortality. They are also the third most prevalent type of infection acquired in hospitals (1, 2). A matter of worry is that SSIs can occur in as many as 30% of all surgical procedures, despite the fact that the majority of them can be prevented (3). SSI is frequently reported in hospitals and is linked to higher rates of illness, longer hospital stays and greater expenses. Diabetes, a persistent metabolic illness marked by high blood sugar levels has been associated with an increased vulnerability to infections due to its significant influence on the immune system and wound healing mechanisms (4, 5).
The Centers for Disease Control and Prevention (CDC) acknowledged the need of infection surveillance over 40 years ago. It has been demonstrated to be an effective measure in preventing SSIs (6). Since its creation in 2005, the CDC's National Healthcare Safety Network has identified SSI as the primary indicator of surgical quality (6). Diabetes is linked to a much higher incidence of wound infection after open surgical operations (7). Additionally, it is considered a risk factor for converting to an open laparoscopic operation and is believed to be linked to higher morbidity rates compared to non-diabetic individuals undergoing the same procedure. Diabetes is a contributing factor that heightens the risk of postoperative infection in surgical patients. (7, 8)
Ensuring proper regulation of blood sugar levels before surgery is of utmost importance, as research has demonstrated that obtaining and sustaining appropriate glucose levels can effectively decrease the occurrence of SSIs. Nevertheless, even with meticulous glucose control, the inherent difficulties of diabetes can lead to delayed wound healing and a higher susceptibility to infections (9, 10).
Clean surgeries have minimal risk of infection providing an excellent opportunity to study the complex relationship between diabetes and the risk of SSI. The goal of this study is to compare the surgical site infections in diabetic versus non-diabetic patients undergone clean surgical procedures at a tertiary care hospital. The findings of this study will offer healthcare practitioners significant knowledge that can guide the development of preoperative plans, postoperative treatment and infection control techniques specifically designed for diabetic patients.

Methodology

This was an observational cohort study conducted from December 2023 to May 2024 at the department of medicine, after taking ethical approval from the hospital.
One hundred ten patients who were scheduled for clean surgical procedures, such as hernia repair and laparoscopic cholecystectomy. The patients were enrolled into two

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groups: those with diabetes mellitus and those without diabetes (55 each cohort), having age 35 to 65 years of either gender. Patients undergoing contaminated or emergency surgeries, history of immunosuppressive therapy or conditions affecting wound healing were excluded. Patient demographics, clinical history, and perioperative data were collected using a structured questionnaire. The presence of diabetes mellitus was confirmed if HbA1c levels were higher than 6.5%. The main outcome was the incidence of SSIs, defined as the occurrence of infection postoperatively. Secondary outcomes included other postoperative complications, such as seroma formation and wound dehiscence.

SPSS 24 was used for analyzing the data. Chi Square test was deployed for assessing the difference between groups keeping the value of P significant at 0.05.

Results

The mean age of the patients in Group A (diabetics) was 49.04 ± 10.15 years, while in Group B (non-diabetics) it was 49.64 ± 8.87 years. The body mass index (BMI) was notably higher in the diabetic group, with a mean of 28.93 ± 1.37 kg/m², compared to the non-diabetic group, which had a mean BMI of 25.07 ± 1.10 kg/m².

Regarding gender distribution, 25 out of 55 diabetic patients (45.5%) were male and 30 (54.5%) were female. In the non-diabetic group, 33 out of 55 patients (60.0%) were male and 22 (40.0%) were female. Socioeconomic status varied across the groups; 20 diabetic patients (36.4%) and 13 non-diabetic patients (23.6%) were classified in the low socioeconomic status category. Middle socioeconomic status was represented by 27 diabetics (49.1%) and 35 non-diabetics (63.6%), while the high socioeconomic status category included 8 diabetics (14.5%) and 7 non-diabetics (12.7%).

In terms of residence, 34 diabetics (61.8%) resided in urban areas compared to 30 non-diabetics (54.5%), whereas rural residency was more common among non-diabetics, with 25 out of 55 patients (45.5%) residing in rural areas compared to 21 diabetics (38.2%). Employment status was relatively similar between the groups, with 18 diabetics (32.7%) and 19 non-diabetics (34.5%) being employed, while the majority of both groups were unemployed (37 diabetics, 67.3% and 36 non-diabetics, 65.5%).

Postoperative complications were assessed, focusing on surgical site infections (SSIs), wound dehiscence and seroma formation. SSIs were observed in 6 out of 55 diabetic patients (10.9%), compared to 2 out of 55 non-diabetic patients (3.6%). However, this difference in SSI occurrence did not reach statistical significance (P = 0.14). Wound dehiscence was reported in 2 diabetics (3.6%) and 1 non-diabetic (1.8%), with no notable difference between the groups (P = 0.55). Seroma formation occurred in 1 diabetic patient (1.8%) but was not observed in any of the non-diabetic patients, though this difference was also not statistically notable (P = 0.31).

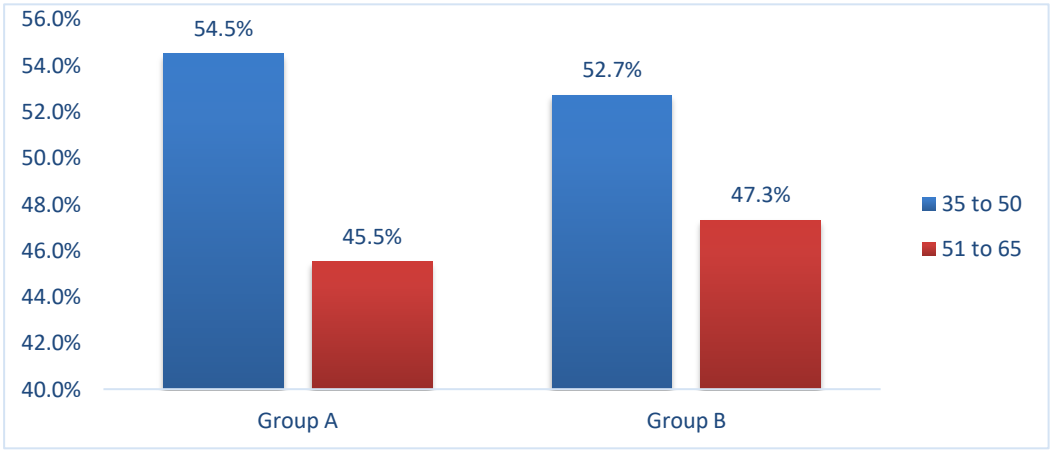

Figure 1 Age distribution

Table 1 Demographics

Demographics		Groups			
		Group A (Diabetics)		Group B (Non-diabetics)	
		N	%	N	%
Gender	Male	25	45.5%	33	60.0%
	Female	30	54.5%	22	40.0%
Socioeconomic status	Low	20	36.4%	13	23.6%
	Middle	27	49.1%	35	63.6%
	High	8	14.5%	7	12.7%
Residence	Urban	34	61.8%	30	54.5%
	Rural	21	38.2%	25	45.5%
Employment status	Employed	18	32.7%	19	34.5%
	Unemployed	37	67.3%	36	65.5%

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Table 2 Comparison of postoperative complications

Postoperative complications		Groups				P value
		Group A (Diabetics)		Group B (Non-diabetics)		
		N	%	N	%	
Surgical site infection	Yes	6	10.9%	2	3.6%	0.14
	No	49	89.1%	53	96.4%	
Wound dehiscence	Yes	2	3.6%	1	1.8%	0.55
	No	53	96.4%	54	98.2%	
Seroma	Yes	1	1.8%	0	0.0%	0.31
	No	54	98.2%	55	100.0%	

Discussion

Wound infections are known to occur more frequently in patients with diabetes. Numerous studies across various surgical procedures have consistently shown that postoperative complications are more common in diabetic patients than in those without diabetes. This increased risk is largely attributed to impaired immune function in diabetic individuals. In open surgical procedures, the risk of infection is heightened due to the larger wounds required for adequate exposure, which is necessary for safe dissection at the target site. These wounds often become a significant source of postoperative morbidity. Specifically, in the context of open cholecystectomy, research has demonstrated that the incidence of surgical site infections (SSI) is higher in diabetic patients compared to their non-diabetic counterparts. (11, 12)

The interplay of diabetes mellitus (DM) and surgical site infections (SSIs) poses significant challenges in surgical and perioperative management. This review has delved into various aspects of this connection, including historical context, epidemiological data, pathophysiological mechanisms, and clinical practices, to provide a comprehensive understanding of the heightened risk of SSIs in diabetic patients and the strategies to minimize this risk. (13, 14)

The importance of thorough perioperative management in reducing SSI risk among diabetic patients is paramount. Preoperative glycemic control is a key factor, with research indicating that maintaining hemoglobin A1c (HbA1c) levels below 7% considerably lowers the likelihood of infectious complications across a range of surgical procedures. This is supported by findings from various studies, which emphasize the significant impact of diabetes on SSI risk. (15, 16) Similarly, studies have highlighted the potential and challenges of glycemic control in cardiac surgeries, further reinforcing the importance of tight glucose regulation in the perioperative context. (17, 18)

Advanced surgical techniques, especially minimally invasive procedures, have also been instrumental in reducing SSI rates. These techniques, due to smaller incisions, decreased postoperative pain and better preservation of immune function contribute significantly to lower incidences of SSIs. Additionally, the World Health Organization's focus on developing evidence-based global guidelines for SSI prevention—emphasizing perioperative practices like optimal oxygenation, maintaining body temperature and blood glucose control—underlines the need for a comprehensive approach to managing SSIs. (19)

Our study was conducted on 110 diabetic and non-diabetic patients. We observed that the frequency of female patients was higher in the diabetic group than the non-diabetic group 54.5% vs 40.0%. To our observation the mean BMI of diabetic group turned out to be higher than the non-diabetic group 28.93 ± 1.37 kg/m² vs 25.07 ± 1.10 kg/m².

The primary outcome in our study was surgical site infection, which was found to be 10.9% in group A (Diabetic) while 3.6% in group B (Non-diabetic), however significant difference was not achieved, similarly wound dehiscence and seroma were also higher in group A when compared to group B, but no notable difference was seen. Our results are comparable to various studies which have reported similar outcomes in terms of postoperative SSI development in diabetic and non-diabetic patients, a study reported that 9 (9.9%) patients in diabetic group had developed SSI after clean surgery while 2 (2.2%) patients in non-diabetic groups, they could not find a notable difference between these two groups as well (8). Another study which was conducted on diabetic and non-diabetic patients having Laparoscopic Cholecystectomy reported that patients in the diabetic group had higher frequency of SSI than non-diabetic group but the difference was not notable (7).

Conclusion

We conclude that the risk of surgical site infection is higher in the diabetic patients as compared to the non-diabetic patients in clean surgical procedures. Glycemic control prior to the surgery and during the surgery can reduce the probability of developing SSI in diabetic patients undergoing clean surgical procedures.

Declarations

Data Availability statement

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-TCHQN-12/22)

Consent for publication

Approved

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Conflict of interest

The authors declared an absence of conflict of interest.

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References

1. Ahuja S, Peiffer-Smadja N, Peven K, White M, Leather AJ, Singh S, et al. Use of feedback data to reduce surgical site infections and optimize antibiotic use in surgery: a systematic scoping review. Annals of surgery. 2022;275(2):e345-e52.
2. Zhou J, Wang R, Huo X, Xiong W, Kang L, Xue Y. Incidence of surgical site infection after spine surgery: a systematic review and meta-analysis. Spine. 2020;45(3):208-16.
3. Shiferaw WS, Aynalem YA, Akalu TY, Petrucka PM. Surgical site infection and its associated factors in Ethiopia: a systematic review and meta-analysis. BMC surgery. 2020;20:1-15.
4. Tariq A, Ali H, Zafar F, Sial A, Hameed K, Naveed S. A systemic review on surgical site infections: classification, risk factors, treatment complexities, economical and clinical scenarios. J Bioequiv Availab. 2017;9(1):336-40.
5. Burgess JL, Wyant WA, Abdo Abujamra B, Kirsner RS, Jozic I. Diabetic wound-healing science. Medicina. 2021;57(10):1072.
6. Martin ET, Kaye KS, Knott C, Nguyen H, Santarossa M, Evans R, et al. Diabetes and risk of surgical site infection: a systematic review and meta-analysis. Infection Control & Hospital Epidemiology. 2016;37(1):88-99.
7. Ismat U, Khan A, Nawaz A, Mansoor R, Malik AA, Sher F, et al. Surgical site infection in diabetic and non-diabetic patients undergoing laparoscopic cholecystectomy. J Coll Physicians Surg Pak [Internet]. 2016;26(2):100-2.
8. Qamar R, Mahmood K, Pervaiz N, Javed R, Sher F, Tufail I. Comparative Study on Incidence of Post-operative Wound Infection in Diabetic vs Non-diabetic Patients in Clean Surgical Procedure. Pakistan Journal of Medical Research. 2023;62(1):14-8.
9. Hwang JU, Son DW, Kang KT, Lee SH, Lee JS, Song GS, et al. Importance of hemoglobin A1c levels for the detection of post-surgical infection following single-level lumbar posterior fusion in patients with diabetes. Korean journal of neurotrauma. 2019;15(2):150-8.
10. Reich MS, Fernandez I, Mishra A, Kafchinski L, Adler A, Nguyen MP. Diabetic control predicts surgical site infection risk in orthopaedic trauma patients. Journal of orthopaedic trauma. 2019;33(10):514-7.
11. Valerius N, Eff C, Hansen N, Karle H, Nerup J, Søeberg B, et al. Neutrophil and lymphocyte function in patients with diabetes mellitus. Acta Medica Scandinavica. 1982;211(6):463-7.
12. Delamaire M, Maugendre D, Moreno M, Le Goff MC, Allannic H, Genetet B. Impaired leucocyte functions in diabetic patients. Diabetic Medicine. 1997;14(1):29-34.
13. Ganesh GV, Ramkumar KM. Macrophage mediation in normal and diabetic wound healing responses. Inflammation Research. 2020;69:347-63.
14. Holl J, Kowalewski C, Zimek Z, Fiedor P, Kaminski A, Oldak T, et al. Chronic diabetic wounds and their treatment with skin substitutes. Cells. 2021;10(3):655.
15. Armstrong DG, Tan T-W, Boulton AJ, Bus SA. Diabetic foot ulcers: a review. Jama. 2023;330(1):62-75.
16. Cheuk N, Worth L, Tatoulis J, Skillington P, Kyi M, Fourlanos S. The relationship between diabetes and surgical site infection following coronary artery bypass graft surgery in current-era models of care. Journal of Hospital Infection. 2021;116:47-52.
17. Beverly JK, Budoff MJ. Atherosclerosis: pathophysiology of insulin resistance, hyperglycemia, hyperlipidemia, and inflammation. Journal of diabetes. 2020;12(2):102-4.
18. Khalid M, Alkaabi J, Khan MA, Adem A. Insulin signal transduction perturbations in insulin resistance. International journal of molecular sciences. 2021;22(16):8590.
19. Arshad S, Rasul A, Batool M, Zukhruf Z, Asad MT. Diabetes and Risk of Surgical Site Infection: A Narrative Review. Journal of Health and Rehabilitation Research. 2024;4(1):567-72.

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