Biological and Clinical Sciences Research Journal
eISSN: 2708-2261; pISSN: 2958-4728
www.bcsrj.com
DOI: https://doi.org/10.54112/bcsrj.v6i1.1507
*Biol. Clin. Sci. Res. J., Volume 6(1), **2025**: 1507*
Original Research Article

Comparison of Surgical Site Infection in Diabetic vs. non-diabetic Patients Operated Electively in the Surgical Unit of MTI-Lady Reading Hospital Peshawar

Wajid[1], Naila Gul[1], Hakeemullah Khan[*2], Muhammad Asif[3], Umer Faiz[4], Hanif Ullah[5], Sidra Jabeen[1]

[1]*Department of General Surgery MTI-Lady Reading Hospital Peshawar, Pakistan*
[2]*Department of Vascular Surgery Combined Military Hospital Peshawar KPK, Pakistan*
[3]*Department of General Medicine MTI-Khyber Teaching Hospital, Peshawar, Pakistan*
[4]*Department of Surgery Combined Military Hospital, Peshawar, Pakistan*
[5]*Department of Surgery Saidu Group of Teaching Hospital Swat, Pakistan*
**Corresponding author`s email address:* hakeemullah246@gmail.com

(Received, 28th November 2024, Revised 6th January 2025, Published 31st January 2025)

Abstract: *Surgical site infections (SSIs) are a major cause of postoperative morbidity, prolonged hospital stays, and increased healthcare costs. Patients with diabetes mellitus are at a higher risk of developing SSIs due to impaired immune responses and delayed wound healing. Understanding the impact of diabetes on SSIs in elective surgeries is crucial for improving perioperative care and patient outcomes.* ***Objective:*** *To compare the incidence of surgical site infections (SSIs) between diabetic and non-diabetic patients undergoing elective surgeries in a surgical unit and to evaluate associated factors influencing infection rates.* ***Methods:*** *This comparative cross-sectional study included 70 patients aged 25 years and above, divided equally into two groups: 35 diabetic patients (Group A) and 35 non-diabetic patients (Group B). The patients underwent elective, open and laparoscopy surgeries with similar perioperative care protocols, including standardised antibiotic prophylaxis. SSIs were identified based on clinical criteria, including purulent discharge, erythema, swelling, fever, and elevated white blood cell counts. Patients were followed for 30 days postoperatively to record infection outcomes.* ***Results:*** *The incidence of SSIs was notably higher in diabetic patients, with 42.9% (n=15) developing infections, compared to 17.1% (n=6) in non-diabetic patients (p<0.05). Demographic characteristics, including age and BMI, were comparable between the two groups. Comorbidities such as obesity and hypertension were more prevalent in diabetic patients, potentially contributing to the increased risk of SSIs. Among the surgical approaches, laparoscopic procedures were more common in both groups, yet the infection rates remained disproportionately higher in the diabetic cohort.* ***Conclusion:*** *Diabetes is a significant independent risk factor for SSIs, even in elective surgical procedures. The findings underscore the need for optimised glycemic control, management of comorbid conditions, and stringent perioperative infection prevention measures to improve surgical outcomes in diabetic patients.*

Keywords: Surgical Site Infection, Diabetes Mellitus, Elective Surgery, Comorbidities, Glycemic Control, Laparoscopic Surgery

[***How to Cite:*** Wajid, Gul N, Khan H., Asif M., Faiz U, Ullah H. Comparison of surgical site infection in diabetic vs non-diabetic patients operated electively in the surgical unit of MTI-lady reading hospital Peshawar. *Biol. Clin. Sci. Res. J.,* **2025;** 6(1): 18-21. doi: https://doi.org/10.54112/bcsrj.v6i1.1506]

Introduction

Postoperative wound infections, also known as surgical site infections, represent an enormous global health challenge. It is probable that rates are elevated in Low- and Middle-income Countries (1). Surgical site infections represent the most prevalent infectious complications in hospitalised patients within nations that are developing, exhibiting a pooled accumulative rate of 5.6 infections for every 100 surgical procedures performed (2). This issue is recognised as a significant challenge in postoperative care, resulting in extended hospital stays and greater financial strain on patients. Despite advancements in surgical techniques and infection control protocols, surgical site infections remain a significant issue in healthcare facilities (3, 4)

These infections typically manifest as primary infections during surgery and secondary infections post-surgery, caused by both exogenous and endogenous microorganisms that infiltrate the operative wound either before the surgical procedure (primary infection) or after the surgery (5). Several factors contribute to the development of surgical site infections. These can be categorised into patient-related factors, including advanced age, nutritional status, and comorbid conditions such as diabetes and hypertension. Additionally, procedure-related factors, such as suboptimal surgical techniques, extended operative times, and insufficient sterilisation of surgical instruments, may significantly elevate the risk of SSIs. In addition to these factors, the virulence and invasiveness of microorganisms are also regarded as significant considerations (6, 7). A clean-contaminated wound is otherwise clean but is created during emergency surgery. In this scenario, the uninflamed upper gastrointestinal tract, typical gallbladder, and urinary bladder are opened without any spillage of contents, although there may be a minor break-in in the aseptic technique. Contaminated wounds refer to traumatic injuries that are less than 6 hours old, as well as wounds involving the inflamed upper gastrointestinal tract as well as obstructed urinary bladder, where there is an opening or spillage of contents. These wounds exhibit significant breaches in sterile technique. The presence of pus defines contaminated wounds and can lead to complications such as intra-peritoneal abscess formation and visceral perforation, particularly in traumatic wounds that are older than 6 hours (6-8)

The heightened risk of infection in individuals with diabetes can be partially linked to physiological changes caused by poor glucose management (9). Chronic hyperglycemia leads to small vessel vasculopathy, which results in local tissue hypoxia and ischemia. This condition can impair the penetration of preventative antibiotics into the surgical field and reduce the production of oxygen-free radicals essential for the phagocytosis of invading bacteria (10).

The rationale for comparing surgical site infections (SSIs) in diabetic and non-diabetic patients who have undergone elective surgery is to comprehend how diabetes affects postoperative wound healing and infection rates. Diabetes, especially when not well managed, is recognised for its negative impact on immune function, blood circulation reduction, and collagen formation changes. The study seeks to ascertain whether further preventive measures, such as more stringent blood sugar control or antibiotic prophylaxis, are necessary to lower infection rates. This comparison will provide essential information to enhance surgical outcomes for diabetic patients and guide clinical strategies for their care during elective surgical procedures.

Methodology

This research utilised a comparative cross-sectional design conducted at the surgery department, Lady Reading Hospital, Peshawar, from March 2024 to September 2024. Seventy patients were recruited and allocated into two equal groups: Group A consisted of 35 diabetic patients, while Group B included 35 non-diabetic patients. The inclusion criteria comprised patients aged 25 years and older scheduled for elective surgeries. Exclusion criteria included individuals undergoing emergency procedures, those with uncontrolled diabetes, and patients presenting with additional comorbidities such as malignancies or severe malnutrition. Patient recruitment utilised purposive sampling, and informed consent was secured before participation. Demographic and clinical characteristics, such as age, gender, body mass index (BMI), comorbid conditions, and type of surgery (open or laparoscopic), were gathered for all participants. Diabetic patients were classified according to their previous diagnosis, and their glycaemic control was assessed using standardised laboratory measurements of fasting blood glucose and HbA1c levels.

The surgeries conducted encompassed elective surgeries, both open and laparoscopy, with rigorous compliance to preoperative preparation protocols aimed at reducing infection risks. Both groups were administered comparable perioperative care, which included antibiotic prophylaxis customised to their specific risk profiles. Postoperative follow-up occurred over 30 days, during which patients were monitored for SSIs. The presence of clinical features, including purulent discharge, erythema, swelling, fever, and elevated white blood cell counts, consistent with established guidelines, determined the diagnostic criteria for surgical site infections (SSIs).

Data were systematically recorded using a structured proforma and analysed to compare the incidence of surgical site infections between the two groups. Statistical analysis utilised SPSS 24 to evaluate the group differences using the Chi-Square test, with a p-value < 0.05 deemed notably significant.

Results

The study compared the occurrence of surgical site infections (SSI) between diabetic (Group A) and non-diabetic (Group B) patients undergoing elective surgeries. The average age of patients in the diabetic group was 47.54 ± 13.13 years, while in the non-diabetic group, it was 51.37 ± 11.28 years. The body mass index (BMI) of diabetic patients averaged 26.73 ± 2.83 kg/m², compared to 26.03 ± 3.15 kg/m² in non-diabetics.

Among diabetic patients, 74.3% were male and 25.7% were female. In contrast, the non-diabetic group comprised 57.1% males and 42.9% females. Regarding educational status, 40.0% of diabetic patients received education, whereas 28.6% of non-diabetic individuals did. Sixty per cent of people with diabetes and seventy-one point four per cent of non-diabetics lacked formal education. The distribution of socioeconomic status exhibited minor variation, with 37.1% of people with diabetes and 34.3% of non-diabetics classified within the low-income category (income <50,000 Rs/month). Patients with middle-income levels (50,000 to 100,000 Rs/month) constituted 51.4% of the diabetic population and 45.7% of the non-diabetic population. In contrast, the high-income group (greater than 100,000 Rs/month) accounted for 11.4% of people with diabetes and 20.0% of non-diabetics.

Surgical approach analysis revealed that laparoscopic surgeries were more common in both groups, constituting 68.6% of surgeries among people with diabetes and 62.9% among non-diabetics. Open surgeries were performed in 31.4% of diabetic cases and 37.1% of non-diabetic cases.

The prevalence of comorbidities was higher in diabetic patients. Hypertension was observed in 62.9% of diabetics compared to 37.1% of non-diabetics. Obesity was present in 71.4% of diabetic patients versus 42.9% of non-diabetic individuals.

The clinical outcome revealed a significant difference in the incidence of surgical site infections. Among diabetic patients, 42.9% developed SSIs, whereas in the non-diabetic group, only 17.1% experienced such infections. Conversely, 57.1% of diabetic patients and 82.9% of non-diabetics did not develop SSIs.

Table 1: Demographic features

Demographics		**Groups**			
		Group A (Diabetic)		**Group B (Non-diabetic)**	
		N	%	N	%
Gender	Male	26	74.3%	20	57.1%
	Female	9	25.7%	15	42.9%
Education status	Educated	14	40.0%	10	28.6%
	Uneducated	21	60.0%	25	71.4%
Socioeconomic status	Low (< 50K Rs/Month)	13	37.1%	12	34.3%
	Middle (50 to 100K Rs/Month)	18	51.4%	16	45.7%
	High (> 100K Rs/Month)	4	11.4%	7	20.0%
Type of surgery	Open	11	31.4%	13	37.1%
	Laparoscopy	24	68.6%	22	62.9%

Table 2: Comparison of surgical site infection between both groups

Clinical outcome		**Groups**			
		Group A (Diabetic)		**Group B (Non-diabetic)**	
		N	**%**	**N**	**%**
Surgical site infection	Yes	15	42.9%	6	17.1%
	No	20	57.1%	29	82.9%

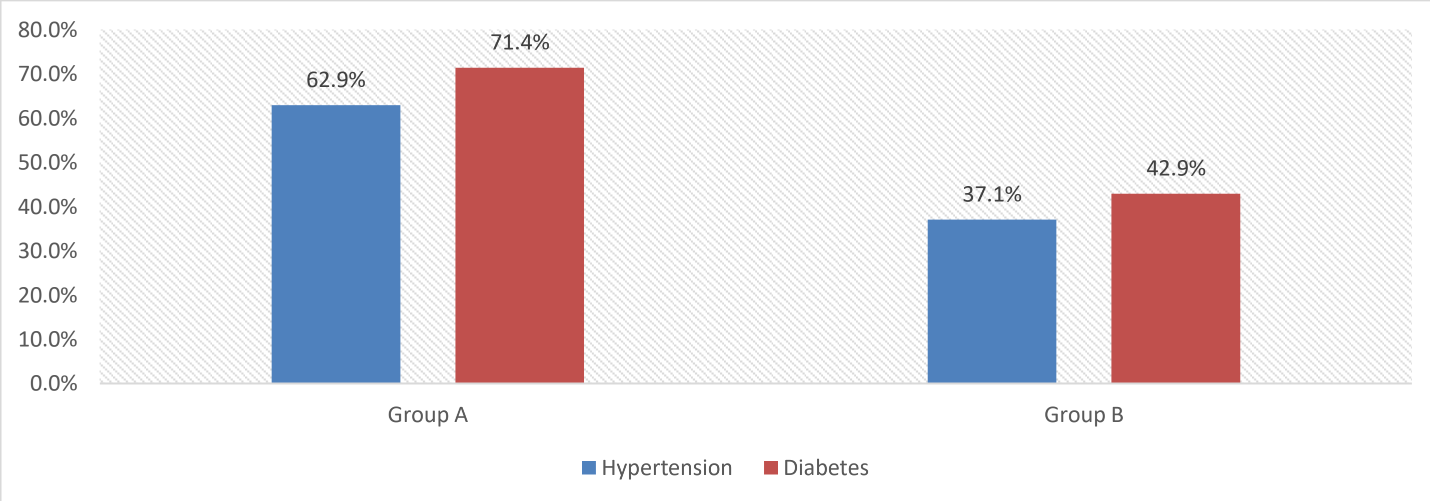

Figure 1: Distribution of comorbidities

Discussion

The comparison of surgical site infections (SSI) in diabetic versus non-diabetic patients undergoing elective surgeries underscores the substantial role of diabetes as a risk factor for postoperative complications. Diabetic patients exhibited a notably greater incidence of SSIs than non-diabetic patients, corroborating findings from multiple studies in the literature. Shahzad M et al. reported a 50% incidence of surgical site infections (SSIs) among diabetic patients with controlled glycaemic levels, in contrast to 16.67% in non-diabetic patients (11). This indicates that well-controlled diabetes increases the risk of infections due to impaired wound healing and altered immune response.Demographic differences between diabetic and non-diabetic groups are evident; however, they often lack statistical significance in the majority of studies. Shahzad M et al. found no significant differences regarding age, gender, BMI, or type of surgery, consistent with findings from other studies, including the meta-analysis by Martin ET et al. (11,12). This review found that diabetes serves as an independent risk factor for surgical site infections (SSIs) across multiple surgical procedures, with an odds ratio (OR) of 1.53, highlighting the systemic implications of diabetes on surgical outcomes (12).Laparoscopic procedures were preferred in both diabetic and non-diabetic groups, indicating progress in minimally invasive surgery and its benefits. Nonetheless, despite these procedural enhancements, diabetes continues to be a considerable risk factor for surgical site infections (SSIs). Ahmad FU et al. reported a higher prevalence of surgical site infections (SSIs) in diabetic patients (12.3%) compared to nondiabetic patients (2.7%) undergoing clean or clean-contaminated surgeries, with an odds ratio of 4.99, highlighting the increased susceptibility of diabetic patients to infections, even in controlled environments (14).Comorbid conditions, including hypertension and obesity, notably contribute to the increased risk of surgical site infections (SSIs) in diabetic patients. Research conducted by He et al. has demonstrated that these conditions, frequently co-occurring with diabetes, increase the risk of infections (13). They reported a notably increased risk of surgical site infections (SSIs) in diabetic patients undergoing orthopaedic surgeries, with an odds ratio (OR) of 1.63. The findings highlight the multifactorial aspects of SSI development in diabetic populations, with hyperglycemia-induced vascular and immune dysfunctions being central factors (13).The extended hospitalisation linked to surgical site infections in diabetic patients presents an added strain on healthcare systems. Ahmad M et al. reported an average hospital stay of 8.2 days for diabetic patients, in contrast to 6.8 days for non-diabetics, highlighting the economic and logistical challenges associated with managing post-surgical infections in diabetic populations (11). The meta-analysis by Martin ET et al. indicated that diabetic patients exhibited a notably elevated risk of deep surgical site infections (SSIs), frequently requiring prolonged antibiotic treatment and, in severe instances, surgical debridement (12).Diabetic patients exhibit increased vulnerability to surgical site infections due to various pathophysiological mechanisms. Chronic hyperglycemia negatively affects neutrophil function, decreases collagen synthesis, and leads to vascular dysfunction, thereby fostering an environment that is favourable for infection (12).

Conclusion

The findings indicate a markedly higher incidence of surgical site infections (SSIs) in diabetic patients (42.9%) relative to non-diabetic patients (17.1%) undergoing elective surgeries. The elevated prevalence of comorbidities, including obesity and hypertension, in diabetic patients further exacerbates this increased risk. Although demographic factors such as age, gender, and BMI are similar, diabetes is identified as an independent risk factor for SSIs. This highlights the necessity for optimised glycemic control and improved infection prevention strategies to enhance surgical outcomes in diabetic patients.

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-LRHP-03P-24)
Consent for publication
Approved
Funding
Not applicable

Conflict of interest

The authors declared the absence of a conflict of interest.

Author Contribution

W (Postgraduate Resident), NG (Postgraduate Resident)
Manuscript drafting, Study Design

HK (Clinical Fellow), MA (Postgraduate Resident)
Review of Literature, Data entry, Data analysis, and drafting article.
UF, HU (Postgraduate Resident), and SJ (Consultant)
Conception of Study, Development of Research Methodology Design, Study Design, manuscript review, critical input.

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

References

1. Rickard J, Beilman G, Forrester J, Sawyer R, Stephen A, Weiser TG, et al. Surgical infections in low-and middle-income countries: a global assessment of the burden and management needs. Surg Infect. 2020;21(6):478-94.
2. Allegranzi B, Bagheri Nejad S, Combescure C. Burden of endemic health-care-associated infection in developing countries: Systematic review and meta-analysis. Lancet 2011;377:228–241.
3. Kolasiński W. Surgical site infections: review of current knowledge and methods of prevention. Polish J Surg. 2019;91(4):41-7.
4. Seidelman JL, Mantyh CR, Anderson DJ. Surgical site infection prevention: a review. JAMA. 2023;329(3):244-52.
5. Pal S, Sayana A, Joshi A, Juyal D. Staphylococcus aureus: A predominant cause of surgical site infections in a rural healthcare setup of Uttarakhand. J Fam Med Prim Care. 2019;8(11):3600-6.
6. Oluwatosin OM. Surgical Wound Infection: A General Overview. Ann Ibadan Postgrad Med. 2005;3(2):26–31.
7. Lilani SP, Jangale N, Chowdhary A, Daver GB. Surgical site infection in clean and clean-contaminated cases. Indian J Med Microbiol. 2005;23(4):249-52.
8. Class I. Prevention (CDC) wound classification and 2017 WSES Classification)[2, 8], it is possible to stratify the surgical field contamination as follows:–Class I= clean wound/surgical field–Class II= clean-contaminated wound/surgical field–Class III= contaminated wound/surgical field. Acute Care Surg. 2023;11:171.
9. Talbot TR. Diabetes mellitus and cardiothoracic surgical site infections. Am J Infect Control. 2005;33(6):353-9.
10. Heinzelmann M, Scott M, Lam T. Factors predisposing to bacterial invasion and infection. Am J Surg. 2002;183(2):179-90.
11. Shahzad M, Saeed B, Qayyum H, et al. Post-operative wound infection after elective abdominal surgery in patients with diabetes with good glycemic control versus patients with no diabetes: A comparative study. Pak Armed Forces Med J. 2024;74(6):1573-1577.
12. Martin ET, Kaye KS, Knott C, et al. Diabetes and risk of surgical site infection: A systematic review and meta-analysis. Infect Control Hosp Epidemiol. 2016;37(1):88-99.
13. He C, Zhou F, Zhou F, et al. Impact of type 2 diabetes on surgical site infections and prognosis post orthopaedic surgery: A systematic review and meta-analysis. Int Wound J. 2024;21:e14422.
14. Ahmad FU, Hassan MM, Khan MA, et al. Comparison of postoperative wound infection in controlled diabetic and non-diabetic patients in elective operations. J Dhaka Med Coll. 2022;31(2):226-231..