

Original Article

# Comparative Study of Postoperative Surgical Site Infection in Diabetic and Non-Diabetic Patients Undergoing General Surgical Procedures

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## ARTICLE INFORMATION

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## ABSTRACT

**Background:** Surgical site infection (SSI) remains an important postoperative complication, and diabetes mellitus may increase susceptibility through hyperglycemia, impaired immune responses, and delayed wound healing. **Objective:** To compare postoperative SSI occurrence and infection characteristics between diabetic and non-diabetic patients undergoing surgical procedures and to describe perioperative glycemic characteristics among diabetic participants. **Methods:** This prospective comparative cohort study included 132 adult patients at DHQ Hospital, Dera Ismail Khan, with 66 diabetic and 66 non-diabetic participants. Patients were followed postoperatively for wound infection. SSI was categorized as superficial, deep, or organ/space infection. **Results:** Sixteen of 132 patients developed SSI (12.1%). SSI occurred in 11/66 diabetic patients (16.7%) and 5/66 non-diabetic patients (7.6%), corresponding to an unadjusted risk ratio of 2.20 (95% CI 0.81–5.98; Pearson  $\chi^2$   $p=0.110$ ). Among infected patients, deep SSI occurred in 9/11 diabetic cases (81.8%) compared with 2/5 non-diabetic cases (40.0%); Fisher's exact  $p=0.245$ . Five infections were superficial, 11 were deep, and no organ/space SSI was recorded. Seven infections occurred during days 7–14 and nine during days 15–30. **Conclusion:** Diabetic patients demonstrated a higher observed postoperative SSI frequency and a greater proportion of deep infections, but these differences were statistically uncertain in this sample. Larger prospective studies with adjustment for surgical and metabolic confounders are required. **Keywords:** surgical site infection; diabetes mellitus; postoperative infection; general surgery; HbA1c; wound infection; hyperglycemia.

## INTRODUCTION

More than 300 million surgical procedures are performed globally each year (1). Postoperative wound complications, particularly surgical site infections (SSIs), remain important sources of morbidity, prolonged hospitalization, repeat treatment, and healthcare expenditure (2–4). SSI encompasses infection involving the surgical incision, deeper incisional tissues, or organ/space structures associated with an operation (2,3). Contemporary prevention strategies emphasize procedure-appropriate antimicrobial prophylaxis, aseptic practice, perioperative optimization, and standardized postoperative surveillance (2–4).

Surgical wound infections may present with local pain, erythema, warmth, swelling, discharge, wound separation, or deeper tissue involvement (2,4,5). The clinical consequences range from relatively limited superficial incisional infection to deep incisional or organ/space infection that may require drainage, prolonged antimicrobial therapy, reoperation, or extended hospitalization (2,4,5). The biological course of wound infection reflects the interaction of microbial burden, host immunity, tissue perfusion, wound characteristics, and local wound conditions (5).

Diabetes mellitus represents an important potential modifier of postoperative wound healing. Type 2 diabetes is characterized by progressive  $\beta$ -cell dysfunction, impaired insulin secretion, insulin resistance, and associated metabolic abnormalities. Chronic hyperglycemia can coexist with dyslipidemia, vascular dysfunction, inflammatory activation, and other metabolic disturbances that may adversely influence postoperative recovery (6).

Evidence from broader surgical populations supports an association between diabetes and postoperative infection. Martin et al. found diabetes to be associated with increased SSI risk across multiple surgical categories, and Zhang et al. reported a similar association in a meta-analysis of prospective cohort studies (7,8). More recent evidence from a large systematic review and meta-analysis of non-cardiac surgery likewise found diabetes associated with increased postoperative infection and wound-healing complications (9). These estimates provide population-level context but do not mean that every individual surgical cohort will demonstrate a statistically significant difference.

Several biological pathways may contribute to increased infection susceptibility in diabetes. Hyperglycemia is associated with disturbances in innate immune and inflammatory responses, oxidative stress, endothelial and microvascular dysfunction, and impaired tissue repair (6,10,11). Altered inflammatory signaling can affect host defense, while microvascular dysfunction may impair oxygen and nutrient delivery to healing tissues (10,11). These mechanisms provide biological plausibility for an association between poor metabolic control and postoperative wound complications.

Perioperative glucose management is therefore an important component of surgical care in patients with diabetes (12–14). In general surgical patients with type 2 diabetes, the RABBIT 2 Surgery randomized trial found that basal-bolus insulin therapy improved inpatient glycemic control and reduced a composite of postoperative complications compared with sliding-scale insulin (12). A meta-analysis of randomized trials further found that more intensive perioperative glycemic-control regimens reduced SSI in several surgical settings, while also increasing hypoglycemia risk, underscoring the need for balanced and individualized management (13,14).

SSI risk is multifactorial. Patient-related characteristics include diabetes, obesity, smoking, nutritional status, vascular disease, immune compromise, and other comorbidities, while procedure-related factors include wound classification, operative duration, surgical approach, tissue trauma, contamination, antimicrobial prophylaxis, and postoperative wound care (2–4,15,16). Systematic reviews of abdominal and colorectal surgery have specifically identified factors such as diabetes, increased BMI, smoking, open surgical approach, higher wound class, and longer operative duration as relevant SSI risk factors (15,16). Variation in these characteristics can confound comparisons between diabetic and non-diabetic patients if they are not measured and adjusted appropriately.

The severity of infection may also be clinically relevant. A superficial incisional infection is not equivalent to a deep incisional or organ/space infection because deeper infection may require more intensive treatment and can be associated with greater morbidity (2,4,5). Comparing both the frequency and pattern of SSI between diabetic and non-diabetic patients may therefore provide more clinically useful information than reporting overall infection occurrence alone.

At DHQ Hospital, Dera Ismail Khan, local prospective data on SSI among diabetic and non-diabetic surgical patients may assist in characterizing postoperative infection burden and identifying areas requiring improved surveillance and metabolic optimization. The present study therefore compared postoperative SSI occurrence and infection type between diabetic and non-diabetic patients undergoing surgical procedures and described perioperative glycemic and clinical characteristics among diabetic participants.

## MATERIALS AND METHODS

### Study Design and Setting

A prospective comparative cohort study was conducted at DHQ Hospital, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan. Adult male and female patients undergoing surgical procedures were enrolled and evaluated prospectively for postoperative surgical site infection.

The study included 132 participants, divided equally into two exposure groups: 66 patients with diabetes mellitus and 66 patients without diabetes mellitus. Participants were aged 18–80 years.

### Eligibility Criteria

Adults undergoing surgery who were willing to provide consent were eligible. Patients undergoing emergency surgery, patients with gestational diabetes, active malignancy, immunocompromised states including HIV/AIDS, patients receiving immunosuppressive therapy, and patients with severe multiple medical complications were excluded.

### Diabetic Group Assessment

Among participants with diabetes, information was collected regarding duration of diabetes, diabetes management, preoperative and postoperative HbA1c classification, and preoperative and postoperative blood glucose levels.

Diabetes management was categorized as oral hypoglycemic medication, insulin, or lifestyle modification. HbA1c was recorded according to the categorical classification used in the study dataset, including controlled and uncontrolled diabetic categories, with an additional normal category in the postoperative assessment. An HbA1c value >8.0% was recorded as uncontrolled.

Blood glucose was categorized as 100–125 mg/dL or >126 mg/dL according to the study's recorded categories.

### Perioperative Management and SSI Assessment

Patients underwent routine preoperative evaluation and postoperative follow-up. A broad-spectrum antimicrobial regimen was administered prophylactically. The reported prophylactic regimen consisted of a second-generation cephalosporin with metronidazole. When unexpected contamination occurred, antimicrobial treatment was continued according to clinical need.

Postoperative dressings were inspected, including a scheduled wound assessment on the fourth postoperative day. Postoperative information was collected on the first day, at seven days, and at 14 days. SSI timing in the completed study dataset was classified as occurring during postoperative days 7–14 or 15–30.

Postoperative wound infection was diagnosed by the responsible surgical unit chief. Infection was subsequently categorized in the study dataset as superficial incisional SSI, deep SSI, or organ/space SSI. When clinically indicated, infected wounds were cleaned and dressed, and delayed primary or secondary closure was performed. Surgical drainage was used where appropriate rather than substituting antimicrobial treatment for source control.

All participants were reported to have changed wound dressings as required and to have adhered to their prescribed antimicrobial regimen.

### Data Collection

Demographic variables included age category, sex, body mass index, and smoking status. Surgical variables included procedure type and surgical approach. Procedures represented in the study included cholecystectomy, hernia repair, appendectomy, dilatation and curettage, hysterectomy, and gastrointestinal surgery. Surgical approach was categorized as open or laparoscopic.

### Statistical Analysis

The original dataset was analysed using IBM SPSS Statistics version 27. Categorical variables were summarized as frequencies and percentages.

For the principal comparison, SSI occurrence was compared between all diabetic and non-diabetic participants. Pearson's chi-square test was used because expected cell frequencies were adequate. Fisher's exact test was additionally calculated as an exact sensitivity analysis. The unadjusted risk ratio and 95% confidence interval were calculated from the reported 2×2 table.

Among participants who developed SSI, the distribution of superficial versus deep infection was compared according to diabetes status using Fisher's exact test because of sparse cell counts. Odds ratios and 95% confidence intervals were calculated as exploratory unadjusted effect estimates. A two-sided p value <0.05 was considered statistically significant.

No multivariable regression estimates were generated because participant-level covariate data sufficient for adjusted modeling were not available.

### Ethical Considerations

Ethical approval was obtained from DHQ Hospital, Dera Ismail Khan, and the research committee of Superior University, Lahore. Consent was required for participation, and participant information was handled according to the study's confidentiality procedures.

## RESULTS

### Participant Characteristics

A total of 132 patients were included. Age was most commonly 34–49 years, comprising 60 participants (45.5%). Twenty-seven participants (20.5%) were aged 18–33 years, 30 (22.7%) were aged 50–65 years, and 15 (11.4%) were aged 66–80 years.

Seventy-two participants (54.5%) were male and 60 (45.5%) were female. Most patients had a BMI within the study-defined healthy range of 18.5–24.9 kg/m<sup>2</sup>, accounting for 115 participants (87.1%). Fourteen (10.6%) were overweight, two (1.5%) were underweight, and one (0.8%) was classified as obese.

Most participants were non-smokers: 97 (73.5%) reported never smoking, 11 (8.3%) were current smokers, and 24 (18.2%) were former smokers.

The most common surgical procedure was cholecystectomy, performed in 37 patients (28.0%), followed by hernia repair in 28 (21.2%), appendectomy in 27 (20.5%), dilatation and curettage in 24 (18.2%), hysterectomy in 14 (10.6%), and gastrointestinal surgery in two (1.5%). Laparoscopic surgery was performed in 81 patients (61.4%), whereas 51 (38.6%) underwent an open procedure.

*Table 1. Demographic, Lifestyle, and Surgical Characteristics of the Study Population*

| Domain                    | Characteristic                          | n   | %     |
|---------------------------|-----------------------------------------|-----|-------|
| <b>Total sample</b>       | All participants                        | 132 | 100.0 |
| <b>Age</b>                | 18–33 years                             | 27  | 20.5  |
|                           | 34–49 years                             | 60  | 45.5  |
|                           | 50–65 years                             | 30  | 22.7  |
|                           | 66–80 years                             | 15  | 11.4  |
|                           |                                         |     |       |
| <b>Sex</b>                | Male                                    | 72  | 54.5  |
|                           | Female                                  | 60  | 45.5  |
| <b>BMI</b>                | Underweight, <18.5 kg/m <sup>2</sup>    | 2   | 1.5   |
|                           | Healthy, 18.5–24.9 kg/m <sup>2</sup>    | 115 | 87.1  |
|                           | Overweight, 25.0–29.9 kg/m <sup>2</sup> | 14  | 10.6  |
|                           | Obese, ≥30 kg/m <sup>2</sup>            | 1   | 0.8   |
| <b>Smoking status</b>     | Non-smoker                              | 97  | 73.5  |
|                           | Current smoker                          | 11  | 8.3   |
|                           | Former smoker                           | 24  | 18.2  |
| <b>Surgical procedure</b> | Cholecystectomy                         | 37  | 28.0  |
|                           | Hernia repair                           | 28  | 21.2  |
|                           | Appendectomy                            | 27  | 20.5  |
|                           | Dilatation and curettage                | 24  | 18.2  |
|                           | Hysterectomy                            | 14  | 10.6  |

| Domain            | Characteristic           | n  | %    |
|-------------------|--------------------------|----|------|
| Surgical approach | Gastrointestinal surgery | 2  | 1.5  |
|                   | Laparoscopic             | 81 | 61.4 |
|                   | Open                     | 51 | 38.6 |
| Diabetes status   | Diabetic                 | 66 | 50.0 |
|                   | Non-diabetic             | 66 | 50.0 |

### Characteristics of the Diabetic Group

Among the 66 patients with diabetes, the duration of diabetes ranged across eight recorded annual categories from seven to 17 years. The largest subgroup had diabetes for 16 years, comprising 18 patients (27.3%).

Oral hypoglycemic medications were used by 49 diabetic participants (74.2%), insulin by 12 (18.2%), and lifestyle modification alone by five (7.6%).

Preoperatively, 13 participants (19.7%) were placed in the study-defined controlled HbA1c category and 53 (80.3%) in the uncontrolled category. Postoperatively, six (9.1%) were categorized as normal, 24 (36.4%) as controlled, and 36 (54.5%) as uncontrolled.

For preoperative blood glucose, nine diabetic participants (13.6%) had values of 100–125 mg/dL and 57 (86.4%) had values >126 mg/dL. Postoperatively, 26 (39.4%) were in the 100–125 mg/dL category and 40 (60.6%) were >126 mg/dL.

*Table 2. Diabetes Duration, Management, and Glycemic Profile Among Diabetic Participants*

| Variable                     | Category                     | n  | % of Diabetic Group |
|------------------------------|------------------------------|----|---------------------|
| Duration of diabetes         | 7 years                      | 5  | 7.6                 |
|                              | 8 years                      | 9  | 13.6                |
|                              | 12 years                     | 4  | 6.1                 |
|                              | 13 years                     | 9  | 13.6                |
|                              | 14 years                     | 5  | 7.6                 |
|                              | 15 years                     | 7  | 10.6                |
|                              | 16 years                     | 18 | 27.3                |
|                              | 17 years                     | 9  | 13.6                |
| Diabetes management          | Oral hypoglycemic medication | 49 | 74.2                |
|                              | Insulin                      | 12 | 18.2                |
|                              | Lifestyle modification       | 5  | 7.6                 |
| Preoperative HbA1c category  | Study-defined controlled     | 13 | 19.7                |
|                              | Uncontrolled (>8.0%)         | 53 | 80.3                |
| Postoperative HbA1c category | Normal (<5.7%)               | 6  | 9.1                 |
|                              | Study-defined controlled     | 24 | 36.4                |
|                              | Uncontrolled (>8.0%)         | 36 | 54.5                |
| Preoperative blood glucose   | 100–125 mg/dL                | 9  | 13.6                |
|                              | >126 mg/dL                   | 57 | 86.4                |
| Postoperative blood glucose  | 100–125 mg/dL                | 26 | 39.4                |
|                              | >126 mg/dL                   | 40 | 60.6                |

### Overall Surgical Site Infection Occurrence

Sixteen of the 132 patients developed SSI, corresponding to an overall infection frequency of 12.1% (95% CI 7.6–18.8%). The remaining 116 patients (87.9%) did not develop SSI.

Among diabetic participants, 11 of 66 developed SSI, corresponding to a frequency of 16.7% (95% CI 9.6–27.4%). Among non-diabetic participants, five of 66 developed SSI, corresponding to 7.6% (95% CI 3.3–16.5%).

The crude SSI risk was therefore approximately 2.20 times higher among diabetic than non-diabetic participants. The 95% confidence interval for the risk ratio was 0.81–5.98. The absolute risk difference was 9.1 percentage points (95% CI –2.3 to 20.7 percentage points).

The primary Pearson chi-square comparison was not statistically significant ( $\chi^2=2.56$ ,  $df=1$ ,  $p=0.110$ ). Fisher's exact test similarly did not demonstrate statistical significance ( $p=0.181$ ).

*Table 3. Primary Comparison of Surgical Site Infection Between Diabetic and Non-Diabetic Patients*

| Diabetes Status     | SSI, n (%) | No SSI, n (%) | SSI Risk, % | Risk Ratio (95% CI) | Pearson p Value |
|---------------------|------------|---------------|-------------|---------------------|-----------------|
| Diabetic (n=66)     | 11 (16.7)  | 55 (83.3)     | 16.7        | 2.20 (0.81–5.98)    | 0.110           |
| Non-diabetic (n=66) | 5 (7.6)    | 61 (92.4)     | 7.6         | Reference           |                 |
| Total (n=132)       | 16 (12.1)  | 116 (87.9)    | 12.1        |                     |                 |

Additional exact analysis: Fisher's exact  $p=0.181$ . Absolute risk difference, diabetic minus non-diabetic = 9.1 percentage points (95% CI –2.3 to 20.7).

### SSI Type and Timing

Of the 16 total infections, five (31.3%) were superficial and 11 (68.8%) were deep. No organ/space SSI was recorded.

Within the diabetic group, nine of the 11 SSI cases (81.8%) were deep and two (18.2%) were superficial. Among the five infected non-diabetic patients, two (40.0%) had deep SSI and three (60.0%) had superficial SSI.

The odds of deep rather than superficial infection were higher among infected diabetic patients, with an unadjusted odds ratio of 6.75; however, the 95% confidence interval was wide (0.64–71.17) and Fisher's exact test was not statistically significant ( $p=0.245$ ). The corresponding Pearson chi-square statistic was 2.798 with  $p=0.094$ , but exact testing is more appropriate because three of four expected cell counts were below five. The recalculated association coefficient was approximately 0.42.

Seven of the 16 infections (43.8%) were recorded during postoperative days 7–14 and nine (56.3%) during days 15–30.

*Table 4. Type and Timing of Surgical Site Infection*

| SSI Characteristic    | Diabetic SSI (n=11) | Non-Diabetic SSI (n=5) | Total SSI (n=16) | Statistical Comparison                                       |
|-----------------------|---------------------|------------------------|------------------|--------------------------------------------------------------|
| Superficial SSI       | 2 (18.2%)           | 3 (60.0%)              | 5 (31.3%)        | OR for deep SSI = 6.75 (95% CI 0.64–71.17); Fisher $p=0.245$ |
| Deep SSI              | 9 (81.8%)           | 2 (40.0%)              | 11 (68.8%)       |                                                              |
| Organ/space SSI       | —                   | —                      | 0 (0.0%)         |                                                              |
| SSI onset: days 7–14  | —                   | —                      | 7 (43.8%)        |                                                              |
| SSI onset: days 15–30 | —                   | —                      | 9 (56.3%)        |                                                              |

No valid patient-level cross-tabulation was available to determine whether SSI occurrence differed independently according to HbA1c, diabetes duration, surgical approach, procedure type, or individual comorbidity after accounting for other factors.

## DISCUSSION

The present prospective comparative study included 132 patients undergoing surgical procedures, equally divided between diabetic and non-diabetic groups. Sixteen patients developed postoperative SSI. The observed infection frequency was higher among diabetic participants than among non-diabetic participants, at 16.7% versus 7.6%, corresponding to an unadjusted risk ratio of 2.20. However, the confidence interval was wide and included the null value, and the primary statistical comparison did not reach conventional significance. The principal finding is therefore a numerical increase in SSI among diabetic patients rather than definitive evidence of an independent diabetic effect.

The direction of the observed difference is consistent with broader evidence. Martin et al. synthesized data across multiple surgical categories and found diabetes associated with a greater likelihood of SSI, while Zhang et al. reached a similar conclusion in a meta-analysis restricted to prospective cohort studies (7,8). A large meta-analysis of non-cardiac surgery also found increased postoperative infection

and wound-healing complications among patients with diabetes (9), and a systematic review and meta-analysis of more than 120,000 primary total knee arthroplasties found a higher infection risk in patients with diabetes (17). The current estimate of approximately twofold greater crude SSI risk therefore accords directionally with established evidence, but the present cohort of 132 patients and only 16 infection events provides substantially less statistical precision than those larger evidence syntheses.

The absence of statistical significance should not be interpreted as proof that diabetes has no relationship with postoperative infection. Rather, the risk ratio confidence interval ranged from a modest reduction to an almost sixfold increase, reflecting considerable uncertainty. With only 11 SSI events in diabetics and five among non-diabetics, the study has limited power for estimating a moderate association precisely.

The study also demonstrated a numerical difference in infection depth. Deep SSI accounted for 81.8% of infections among diabetic patients and 40.0% among infected non-diabetic patients. The estimated odds ratio for deep rather than superficial infection was 6.75, but the confidence interval was very wide and Fisher's exact test was non-significant. Consequently, the data suggest a possible tendency toward deeper infection among diabetics but do not establish a reliable severity difference.

Diabetes provides several biologically plausible mechanisms for increased wound-infection susceptibility. Chronic hyperglycemia is associated with oxidative stress, inflammatory dysregulation, endothelial dysfunction, abnormalities in innate immune responses, and microvascular impairment (6,10,11). These changes may compromise local tissue perfusion, immune-cell function, bacterial clearance, angiogenic responses, and tissue repair (6,10,11). Wound infection itself reflects a dynamic interaction between host defense, microbial burden, wound environment, perfusion, and tissue integrity (5).

The diabetic cohort demonstrated a substantial burden of poor glycemic control according to the study's recorded categories. Fifty-three of 66 diabetic participants were classified as uncontrolled preoperatively, and 36 remained in the uncontrolled category postoperatively. Preoperative blood glucose exceeded 126 mg/dL in 57 diabetic patients, while 40 remained above this level postoperatively. These descriptive findings reinforce the clinical importance of perioperative glycemic management, but the current aggregate data do not establish that a particular HbA1c category caused SSI or determined infection depth. A patient-level comparison incorporating both infected and non-infected diabetic patients is necessary to quantify that relationship appropriately. Evidence from general surgical populations nevertheless supports structured perioperative glucose management: the RABBIT 2 Surgery randomized trial demonstrated improved glycemic control and fewer composite postoperative complications with basal-bolus insulin compared with sliding-scale treatment, while a meta-analysis of randomized trials found lower SSI rates with more intensive glycemic-control regimens in selected surgical settings (12,13). Contemporary multidisciplinary guidance likewise emphasizes individualized perioperative diabetes plans, glucose monitoring, and safe insulin management (14). Recent large multicentre observational evidence also supports the clinical relevance of preoperative HbA1c and overall glycemic control to postoperative outcomes (18).

A further consideration is that HbA1c is primarily a marker of longer-term glycemic exposure, whereas capillary or serum glucose measurements provide more immediate information about perioperative dysglycemia (14,18). Interpretation of "postoperative HbA1c" therefore depends strongly on the interval at which it was measured. Future analyses should distinguish long-term glycemic status from acute perioperative glucose control clearly.

The surgical population was heterogeneous. Cholecystectomy, hernia repair, appendectomy, dilatation and curettage, hysterectomy, and gastrointestinal operations were all represented. Approximately 61% of procedures were laparoscopic and 39% were open. Procedure type and operative approach can influence SSI risk through differences in incision size, tissue handling, operative exposure, contamination, and surgical complexity; systematic reviews in abdominal and colorectal surgery have identified open approach and other procedure-related characteristics as relevant SSI risk factors (15,16). Consequently, an unadjusted diabetic-versus-non-diabetic comparison may partly reflect differences in surgical case mix if those characteristics were not evenly distributed between groups.

This issue is particularly important because the available demographic and operative characteristics were presented for the entire cohort rather than separately according to diabetes status. It is therefore not possible to establish whether diabetic and non-diabetic groups were comparable in age, sex, BMI, smoking, surgical procedure, surgical approach, or other infection-related factors. Without such baseline stratification or multivariable adjustment, the estimated risk ratio remains a crude association.

Smoking was reported by a minority of participants, with 8.3% current smokers and 18.2% former smokers. Smoking, increased BMI, and adverse nutritional markers have been identified among patient-related factors associated with SSI in abdominal surgical populations (15,16). These factors may operate alongside metabolic and vascular risk. Although overall BMI distribution was available, its distribution by diabetes status and SSI occurrence was not reported, preventing assessment of its confounding effect. The study employed prophylactic antimicrobial therapy, with a second-generation cephalosporin plus metronidazole reported as the recommended regimen. Antimicrobial prophylaxis remains an important component of SSI prevention, but appropriate agent selection, timing, dosing/redosing, procedure specificity, and duration are central to contemporary practice (2–4,19). Updated recommendations emphasize that antimicrobial prophylaxis should be integrated with a broader package of perioperative SSI-prevention measures rather than relied upon in isolation (3,4,19).

All participants were reported to comply with prescribed postoperative antibiotics and wound dressing changes. While this suggests good adherence to postoperative care, uniform self-reported adherence also limits the ability to evaluate these variables as predictors of infection. Objective documentation of timing, dosing, wound-care procedures, and post-discharge adherence would strengthen future studies. No organ/space SSI was identified. Most infections were deep, and slightly more than half were recorded during postoperative days 15–30. This finding highlights the importance of surveillance after hospital discharge because SSIs may present after the early inpatient period and can be underdetected by inpatient-only follow-up (3,20). Contemporary post-discharge surveillance approaches, including structured digital follow-up and wound-image review, have been evaluated as methods to improve detection after discharge (20).

A major analytical distinction is necessary between risk of developing SSI and type of SSI after infection has occurred. The original severity table included only 16 patients who developed SSI. It can answer whether the distribution of superficial and deep infection differed between diabetic and non-diabetic infected patients, but it cannot estimate the relative risk of developing SSI because patients without infection are excluded from that analysis. The present analysis separates these two questions.

The study also collected detailed diabetic characteristics, including diabetes duration, therapeutic management, HbA1c, and blood glucose. These data are valuable for describing the population. However, a valid risk-factor analysis would require consistent patient-level cross-tabulation of each candidate exposure against SSI occurrence, followed by multivariable modeling if the number of events and sample size permitted. With only 16 total SSI events, the complexity and stability of any multivariable logistic model would be constrained, and excessive numbers of candidate covariates would increase the risk of overfitting and unstable estimates (21).

The present study has several strengths. Data were collected prospectively, equal numbers of diabetic and non-diabetic patients were enrolled, multiple surgical procedures were represented, and SSI occurrence and depth were documented. The data also allow direct calculation of an interpretable crude risk ratio rather than reliance on descriptive percentages alone.

The limitations are substantial. This was a single-centre study with a relatively small number of SSI events. Demographic and surgical characteristics were not presented separately for diabetic and non-diabetic groups, preventing assessment of baseline comparability. No adjusted analysis was available. Surgical procedures and approaches were heterogeneous, and wound class, operative duration, nutritional status, perioperative temperature, antimicrobial timing, and several other established SSI-related variables were not available for group-level adjustment; these characteristics are recognized contributors to SSI risk in contemporary prevention guidance and surgical risk-factor reviews (2–4,15,16). The glycemic categories also require clearer operational definition, and the timing of postoperative HbA1c measurement is important for interpretation. Follow-up procedures across the entire 30-day postoperative interval should be standardized and explicitly documented. These limitations mean that the current results should be regarded as exploratory comparative evidence rather than proof that diabetes independently caused the observed infections.

Future multicentre prospective studies should collect participant-level data on age, sex, BMI, smoking, diabetes duration, HbA1c, perioperative glucose, procedure type, wound classification, surgical approach, operative duration, antimicrobial prophylaxis, comorbidities, and postoperative wound care. Multivariable modeling could then determine whether diabetes and glycemic control remain independently associated with SSI after adjustment for surgical and patient-related confounders.

## CONCLUSION

In this prospective cohort of 132 surgical patients, postoperative SSI occurred in 16.7% of diabetic patients compared with 7.6% of non-diabetic patients. The unadjusted relative risk was 2.20, but the 95% confidence interval crossed unity and the difference was not statistically significant.

Among patients who developed SSI, deep infection was more frequent in the diabetic group than in the non-diabetic group, but this comparison was also statistically uncertain because of the small number of infection events.

The findings therefore demonstrate a higher observed SSI burden among diabetic patients but do not establish diabetes as an independent predictor of SSI in this cohort. Perioperative glycemic assessment, evidence-based SSI-prevention practices, and careful postoperative wound surveillance remain clinically important (3,4,14,19,20). Larger, adequately powered studies with patient-level adjustment for surgical and metabolic confounders are required to quantify the independent contribution of diabetes and glycemic control.

## LIMITATIONS

The study was performed at a single institution, which limits external generalizability. Although 132 participants were included, only 16 developed SSI, limiting precision for subgroup and severity comparisons.

Baseline demographic and operative characteristics were reported for the overall population rather than separately for diabetic and non-diabetic groups. It was therefore not possible to determine whether the groups differed in age, sex, BMI, smoking status, procedure type, surgical approach, or other potential confounders.

No multivariable analysis was available to determine whether diabetes was independently associated with SSI after adjustment for other patient- and procedure-related factors. The diverse surgical case mix may also have introduced heterogeneity in baseline SSI risk.

The study duration was relatively short, and long-term consequences of SSI were not evaluated. Self-reported lifestyle and postoperative adherence variables may have been affected by recall or reporting bias.

The available glycemic data were categorical, and the exact timing and operational thresholds used for some HbA1c categories require clearer definition. These limitations reduce the ability to establish a dose-response relationship between glycemic control and SSI.

## RECOMMENDATIONS

Patients with diabetes undergoing surgery should receive structured preoperative metabolic assessment and appropriate perioperative glucose management. HbA1c contributes information about longer-term glycemic status, while perioperative glucose measurement remains important for immediate metabolic management and treatment decisions (14,18).

SSI-prevention protocols should incorporate procedure-appropriate antimicrobial prophylaxis, aseptic surgical practice, perioperative optimization, wound surveillance, and standardized postoperative wound care in accordance with institutional and evidence-based guidance (3,4,19).

Patients with diabetes and additional vascular, metabolic, nutritional, or immunological risk factors may warrant particularly careful postoperative wound surveillance because SSI susceptibility is shaped by interacting host, metabolic, and surgical factors (6,11,15).

Future research should use larger multicentre prospective cohorts and report diabetic and non-diabetic baseline characteristics separately. Participant-level data should permit adjustment for age, BMI, smoking, procedure type, surgical approach, operative duration, wound class, diabetes duration, HbA1c, perioperative glucose, antimicrobial prophylaxis, and relevant comorbidity, while limiting model complexity to what the number of outcome events can support (15,16,21).

Post-discharge surveillance should extend through the complete SSI surveillance interval using a clearly documented follow-up mechanism so that infections presenting after hospital discharge are not missed (3,20).

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