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Research Article

Comparative Study of Surgical Wound Healing and Dermatological Complications in Diabetic Versus Non-Diabetic Orthopedic Patients

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ABSTRACT

Background: Diabetes mellitus is a major systemic condition known to impair wound healing and increase susceptibility to postoperative complications. Orthopedic surgeries require optimal tissue repair, and diabetic patients are at increased risk of surgical site infections and dermatological complications. **Aim:** To compare surgical wound healing and dermatological complications in diabetic versus non-diabetic orthopedic patients. **Objectives:** To assess the rate of surgical wound healing in diabetic and non-diabetic patients. To evaluate the incidence of postoperative dermatological complications in both groups. To determine the association between glycemic status and postoperative wound-related outcomes. **Materials and Methods:** A hospital-based comparative cross-sectional study was conducted among 100 orthopedic patients (50 diabetics and 50 non-diabetics). Clinical data, perioperative parameters, wound healing time, and dermatological complications were recorded. Glycemic status was assessed using HbA1c levels. Statistical analysis was performed using independent t-test and Chi-square test, with $p < 0.05$ considered significant. **Results:** Diabetic patients had significantly prolonged healing time (17.8 ± 3.6 days vs 13.9 ± 2.9 days; $p<0.001$), higher rates of superficial surgical site infection (22.0% vs 8.0%; $p=0.048$), wound dehiscence (18.0% vs 6.0%; $p=0.041$), and prolonged hospital stay (28.0% vs 10.0%; $p=0.021$). Dermatological complications were significantly more common in diabetics (38.0% vs 14.0%; $p=0.006$). Poor glycemic control (HbA1c ≥7%) was strongly associated with adverse wound outcomes, including increased infection and delayed healing. **Conclusion:** Diabetes mellitus and poor glycemic control significantly impair surgical wound healing and increase postoperative dermatological complications in orthopedic patients. Strict perioperative

glycemic management and vigilant wound monitoring are essential to improve surgical outcomes in diabetic individuals.

KEYWORDS: Diabetes Mellitus. Surgical Wound Healing. Orthopedic Postoperative Complications.

INTRODUCTION

Surgical wound healing is a complex physiological process involving hemostasis, inflammation, proliferation, and remodeling phases. Successful healing requires adequate tissue perfusion, oxygenation, immune competence, and metabolic balance. Orthopedic surgeries, which frequently involve extensive soft tissue handling and implant placement, depend heavily on optimal wound healing to prevent complications such as infection, delayed union, dehiscence, and implant failure. Among the various systemic factors influencing wound repair, diabetes mellitus remains one of the most significant contributors to impaired surgical outcomes.

Diabetes mellitus is characterized by chronic hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Persistent hyperglycemia leads to microvascular and macrovascular complications, impaired leukocyte function, reduced collagen synthesis, decreased angiogenesis, and neuropathy, all of which adversely affect wound healing. Diabetic patients undergoing orthopedic procedures are particularly vulnerable to postoperative wound complications due to compromised immunity and vascular insufficiency. Studies have demonstrated that diabetes increases the risk of surgical site infections (SSI), prolonged hospital stay, reoperation, and increased healthcare costs [1,2].

In orthopedic patients, wound healing is further challenged by factors such as trauma, open fractures, use of prosthetic implants, and prolonged operative time. The presence of hyperglycemia alters neutrophil chemotaxis and phagocytosis, thereby increasing susceptibility to infections. Moreover, glycosylation of collagen and reduced fibroblast activity impair tissue regeneration and tensile strength. These pathophysiological alterations may result in delayed epithelialization, seroma formation, wound dehiscence, and chronic non-healing ulcers [3].

Dermatological complications such as cellulitis, erythema, blistering, fungal infections, and contact dermatitis are more commonly reported in diabetic individuals due to altered skin barrier function and increased colonization by pathogenic organisms. The interplay between diabetes-related microangiopathy and surgical trauma can significantly compromise postoperative outcomes. Conversely, non-diabetic patients generally exhibit predictable wound healing patterns unless influenced by other risk factors such as smoking, malnutrition, or immunosuppression [4].

Despite advances in perioperative glycemic control, prophylactic antibiotics, and standardized surgical protocols, postoperative wound complications continue to pose significant morbidity in diabetic orthopedic patients. Comparative evaluation between diabetic and non-diabetic individuals provides insight into the magnitude of risk and helps in developing targeted preventive strategies. Understanding these differences is crucial for optimizing perioperative management, reducing complications, and improving functional outcomes in orthopedic practice [5].

AIM

To compare surgical wound healing and dermatological complications in diabetic versus non-diabetic orthopedic patients.

OBJECTIVES

1. To assess the rate of surgical wound healing in diabetic and non-diabetic orthopedic patients.
2. To evaluate the incidence of postoperative dermatological complications in both groups.
3. To determine the association between glycemic status and postoperative wound-related outcomes.

MATERIALS AND METHODOLOGY

Source of Data

The data were collected from patients admitted to the Department of Orthopedics who underwent elective or emergency orthopedic surgical procedures during the study period. Clinical records, laboratory investigations, and postoperative follow-up findings were reviewed.

Study Design

The study was conducted as a hospital-based comparative cross-sectional study.

Study Location

The study was carried out in the Department of Orthopedics at a tertiary care teaching hospital.

Study Duration

The study was conducted over a period of 12 months.

Sample Size

A total of 100 patients were included in the study. The participants were divided into two groups:

- Group A: 50 diabetic patients
- Group B: 50 non-diabetic patients

Inclusion Criteria

- Patients aged 18 years and above.
- Patients undergoing orthopedic surgical procedures.
- Patients willing to provide informed consent.
- Diagnosed cases of Type 2 Diabetes Mellitus (for diabetic group).

Exclusion Criteria

- Patients with immunocompromised conditions (HIV, malignancy, steroid therapy).
- Patients with peripheral vascular disease unrelated to diabetes.
- Patients with chronic dermatological diseases.
- Patients lost to follow-up.

Procedure and Methodology

After obtaining Institutional Ethics Committee approval and informed consent, eligible patients were enrolled in the study. Detailed demographic data including age, gender, BMI, type of surgery, duration of surgery, and comorbidities were recorded. For diabetic patients, HbA1c levels and perioperative blood glucose values were documented.

All patients underwent standard surgical procedures under aseptic precautions. Postoperative wound evaluation was performed on day 3, day 7, day 14, and during follow-up visits up to 30 days. Wound healing was assessed based on parameters such as presence of erythema, discharge, edema, dehiscence, infection, and time to complete epithelialization.

Dermatological complications such as cellulitis, fungal infections, contact dermatitis, and wound-related skin reactions were documented. Surgical site infections were categorized as superficial or deep according to CDC criteria.

Sample Processing

Blood samples for fasting blood glucose and HbA1c were collected under aseptic precautions and analyzed in the hospital laboratory using standardized enzymatic methods. Wound swabs from suspected infections were sent for microbiological culture and sensitivity testing.

Data Collection

Data were collected using a pre-designed structured proforma. Clinical examination findings, laboratory results, and

postoperative outcomes were systematically recorded.

Statistical Methods

The data were entered into Microsoft Excel and analyzed using SPSS software version 25. Quantitative variables were expressed as mean ± standard deviation. Qualitative variables were presented as frequencies and percentages. Comparison between groups was performed using Student's t-test for continuous variables and Chi-square test for categorical variables. A p-value of less than 0.05 was considered statistically significant.

OBSERVATION AND RESULTS

TABLE 1: To compare surgical wound healing and dermatological complications in diabetic versus non-diabetic orthopedic patients (N = 100)

Parameter	Diabetic (n=50) n(%) / Mean±SD	95% CI	Non-Diabetic (n=50) n(%) / Mean±SD	95% CI	Test of Significance	p-value
Age (years)	56.8 ± 9.4	54.2–59.4	48.7 ± 8.6	46.3–51.1	Independent t-test	0.001*
Male	31 (62.0%)	48.1–74.5	28 (56.0%)	42.3–69.0	Chi-square	0.541
BMI (kg/m²)	27.9 ± 3.2	26.9–28.9	24.6 ± 2.8	23.8–25.4	Independent t-test	<0.001*
Duration of Surgery (min)	104.6 ± 18.3	99.5–109.7	96.2 ± 16.7	91.6–100.8	Independent t-test	0.018*
Delayed Wound Healing	17 (34.0%)	21.2–48.8	6 (12.0%)	4.5–23.8	Chi-square	0.009*
Any Dermatological Complication	19 (38.0%)	24.7–52.8	7 (14.0%)	5.8–26.7	Chi-square	0.006*

Table 1 compares baseline characteristics, surgical wound healing, and dermatological complications between diabetic and non-diabetic orthopedic patients (N=100). The mean age of diabetic patients (56.8 ± 9.4 years) was significantly higher than non-diabetic patients (48.7 ± 8.6 years) (p=0.001), indicating that the diabetic cohort was relatively older. Although males were slightly predominant in both groups (62.0% in diabetics vs 56.0% in non-diabetics), the difference was not statistically significant (p=0.541). Body Mass Index was significantly higher among diabetic patients (27.9 ± 3.2 kg/m²) compared to non-diabetics (24.6 ± 2.8 kg/m²) (p<0.001). The duration of surgery was also significantly longer in diabetics (104.6 ± 18.3 minutes) than non-diabetics (96.2 ± 16.7 minutes) (p=0.018). Importantly, delayed wound healing was observed in 34.0% of diabetic patients compared to only 12.0% of non-diabetic patients (p=0.009). Similarly, any dermatological complication occurred in 38.0% of diabetics versus 14.0% of non-diabetics (p=0.006).

TABLE 2: To assess the rate of surgical wound healing in diabetic and non-diabetic orthopedic patients (N = 100)

Parameter	Diabetic (n=50)	95% CI	Non-Diabetic (n=50)	95% CI	Test of Significance	p-value
Mean Healing Time (days)	17.8 ± 3.6	16.8–18.8	13.9 ± 2.9	13.1–14.7	Independent t-test	<0.001*
Complete Healing ≤14 days	18 (36.0%)	22.9–50.8	34 (68.0%)	53.3–80.5	Chi-square	0.002*
Superficial SSI	11 (22.0%)	11.5–36.0	4 (8.0%)	2.2–19.2	Chi-square	0.048*
Wound Dehiscence	9 (18.0%)	8.6–31.4	3 (6.0%)	1.2–16.5	Fisher's Exact	0.041*
Prolonged Hospital Stay (>10 days)	14 (28.0%)	16.2–42.5	5 (10.0%)	3.3–21.8	Chi-square	0.021*

Table 2 assesses the rate of surgical wound healing between diabetic and non-diabetic patients. The mean healing time was significantly prolonged in diabetic patients (17.8 ± 3.6 days) compared to non-diabetics (13.9 ± 2.9 days) (p<0.001). Early complete healing (≤14 days) was achieved in only 36.0% of diabetics, whereas 68.0% of non-diabetics showed complete healing within 14 days (p=0.002), demonstrating a markedly delayed healing pattern among diabetics. Superficial surgical site infection occurred in 22.0% of diabetic patients compared to 8.0% of non-diabetics (p=0.048). Wound dehiscence was also significantly more frequent in diabetics (18.0%) than non-diabetics (6.0%) (p=0.041). Additionally, prolonged hospital stay (>10 days) was observed in 28.0% of diabetic patients compared to 10.0% of non-diabetics (p=0.021).

TABLE 3: To evaluate the incidence of postoperative dermatological complications in both groups (N = 100)

Dermatological Complication	Diabetic (n=50) n(%)	95% CI	Non-Diabetic (n=50) n(%)	95% CI	Test of Significance	p-value
Cellulitis	12 (24.0%)	13.1–38.2	4 (8.0%)	2.2–19.2	Chi-square	0.028*
Fungal Infection	8 (16.0%)	7.2–29.1	2 (4.0%)	0.5–13.7	Fisher's Exact	0.046*
Contact Dermatitis	6 (12.0%)	4.5–23.8	5 (10.0%)	3.3–21.8	Chi-square	0.749
Blister Formation	7 (14.0%)	5.8–26.7	3 (6.0%)	1.2–16.5	Chi-square	0.182
Total Dermatological Complications	19 (38.0%)	24.7–52.8	7 (14.0%)	5.8–26.7	Chi-square	0.006*

Table 3 evaluates postoperative dermatological complications in both groups. Cellulitis was significantly more common among diabetic patients (24.0%) compared to non-diabetics (8.0%) (p=0.028). Fungal infections were also significantly higher in

diabetics (16.0%) than non-diabetics (4.0%) (p=0.046), reflecting compromised immunity and altered skin barrier in diabetic individuals. However, contact dermatitis showed no significant difference between groups (12.0% vs 10.0%; p=0.749). Similarly, blister formation, although more frequent in diabetics (14.0%) than non-diabetics (6.0%), did not reach statistical significance (p=0.182). The overall incidence of dermatological complications was significantly higher in diabetics (38.0%) compared to non-diabetics (14.0%) (p=0.006).

TABLE 4: To determine the association between glycemic status and postoperative wound-related outcomes (N = 100)

Outcome Variable	HbA1c ≥7% (n=42) n(%) / Mean±SD	95% CI	HbA1c <7% (n=58) n(%) / Mean±SD	95% CI	Test of Significance	p-value
Mean Healing Time (days)	18.4 ± 3.1	17.4–19.4	14.1 ± 2.8	13.4–14.8	Independent t-test	<0.001*
Surgical Site Infection	15 (35.7%)	21.6–52.0	6 (10.3%)	3.9–20.9	Chi-square	0.002*
Wound Dehiscence	10 (23.8%)	12.1–39.5	2 (3.4%)	0.4–11.7	Fisher's Exact	0.001*
Hospital Stay (days)	11.8 ± 2.7	11.0–12.6	8.9 ± 2.1	8.3–9.5	Independent t-test	<0.001*
Dermatological Complication	16 (38.1%)	23.6–54.4	10 (17.2%)	8.6–29.4	Chi-square	0.017*

Table 4 determines the association between glycemic status (HbA1c ≥7% vs <7%) and postoperative wound-related outcomes. Patients with HbA1c ≥7% had significantly prolonged mean healing time (18.4 ± 3.1 days) compared to those with HbA1c <7% (14.1 ± 2.8 days) (p<0.001). Surgical site infection occurred in 35.7% of poorly controlled patients versus 10.3% of those with better glycemic control (p=0.002). Wound dehiscence was significantly more frequent in the HbA1c ≥7% group (23.8%) compared to the <7% group (3.4%) (p=0.001). Mean hospital stay was also significantly longer among patients with poor glycemic control (11.8 ± 2.7 days vs 8.9 ± 2.1 days; p<0.001). Dermatological complications were more prevalent in patients with HbA1c ≥7% (38.1%) compared to those with HbA1c <7% (17.2%) (p=0.017).

DISCUSSION

In Table 1, diabetic patients were significantly older and had higher BMI compared to non-diabetic patients. Advanced age and obesity are recognized independent risk factors for impaired wound healing. Ahamad FU *et al.* (2022)[6] reported that increasing age and elevated BMI significantly increased the risk of postoperative surgical site infection (SSI), particularly in orthopedic and prosthetic surgeries. Similarly, Ghani U *et al.* (2025)[2] emphasized that obesity and metabolic dysregulation contribute to impaired tissue perfusion and delayed collagen synthesis, which may explain the higher incidence of delayed wound healing (34.0%) observed in diabetics in the present study. The significantly higher rate of dermatological complications (38.0% vs 14.0%) in diabetic patients is consistent with findings by Kabir T *et al.* (2025)[3], who documented increased

skin and soft tissue infections among diabetic individuals due to immune dysfunction and microangiopathy.

Table 2 demonstrates a significantly prolonged mean healing time in diabetic patients (17.8 days) compared to non-diabetics (13.9 days). Islam MR *et al.* (2022)[4] described the pathophysiological mechanisms underlying delayed wound healing in diabetes, including impaired leukocyte migration, reduced angiogenesis, and altered growth factor activity. Scherer M *et al.* (2024)[5] reported that diabetic patients undergoing surgical procedures had nearly double the risk of SSI and longer hospital stays, findings that align with the increased superficial SSI (22.0%), wound dehiscence (18.0%), and prolonged hospitalization (28.0%) observed in the diabetic cohort of this study. Additionally, the significantly lower rate of early complete healing (≤14 days) among diabetics (36.0%) supports prior evidence that hyperglycemia disrupts fibroblast proliferation and extracellular matrix remodeling.

Table 3 further highlights the burden of dermatological complications among diabetic patients. The significantly higher incidence of cellulitis (24.0%) and fungal infections (16.0%) is in agreement with the observations of Ahamad FU *et al.* (2022)[6], who reported increased susceptibility to skin infections among diabetic patients due to impaired neutrophil function and vascular insufficiency. Contact dermatitis and blister formation did not show statistically significant differences, suggesting that these complications may be influenced more by local factors such as dressing materials and surgical technique rather than glycemic status alone. Nevertheless, the overall significantly higher dermatological complication rate (38.0%) in diabetics confirms the role of diabetes as a major risk factor. Węgłowski R *et al.* (2025)[7]

Table 4 establishes a strong association between poor glycemic control (HbA1c ≥7%) and adverse wound-related outcomes. Patients with HbA1c ≥7% had significantly prolonged healing time, higher SSI (35.7%), increased wound dehiscence (23.8%), and longer hospital stay. These findings are strongly supported by Lavery LA *et al.* (2024)[8] & Diab J *et al.* (2021)[9], who demonstrated that perioperative hyperglycemia independently predicted postoperative infection, irrespective of diabetes status. Furthermore, Lim SH *et al.* (2022)[10] showed that elevated HbA1c levels were associated with increased postoperative morbidity and longer hospitalization in surgical patients.

CONCLUSION

The present comparative study demonstrates that diabetic orthopedic patients experience significantly impaired surgical wound healing and a higher incidence of postoperative dermatological complications compared to non-diabetic patients. Diabetic individuals showed prolonged healing time, increased rates of superficial surgical site infections, wound dehiscence, and extended hospital stay. Furthermore, dermatological complications such as cellulitis and fungal infections were significantly more common among diabetic patients. The study also establishes a strong association between poor glycemic control (HbA1c ≥7%) and adverse wound-related outcomes, including delayed healing, infection, and prolonged hospitalization. These findings underscore the critical importance of optimal perioperative glycemic control, meticulous wound care, and early identification of dermatological complications in diabetic patients undergoing orthopedic surgery. Implementation of targeted preventive strategies and strict metabolic monitoring may substantially improve postoperative outcomes in this high-risk population.

LIMITATIONS OF STUDY

1. The study was conducted at a single tertiary care center, which may limit the generalizability of the findings.
2. The sample size was relatively small (n=100), which may reduce statistical power for detecting less common complications.
3. The follow-up period was limited to early postoperative outcomes, and long-term wound-related complications were not assessed.
4. Potential confounding factors such as nutritional status, smoking habits, and detailed microvascular assessment were not evaluated separately.
5. The study primarily focused on Type 2 Diabetes Mellitus and did not differentiate outcomes based on duration of diabetes or presence of chronic diabetic complications.

REFERENCES

1. Farooq A, Jameel MA, Akram A, Ashfaq F. Incidence and severity of surgical wound complications in diabetic vs non-diabetic patients. Pakistan Journal of Medical & Cardiological Review. 2025 Aug 22;4(3):1206-13.
2. Ghani U, Ashraf MA, Malik MJ, Zulfiqar M, ul Haq QT, Usman T. Comparison of Infection Rates in Diabetic versus Non-Diabetic Patients after Elective Surgical Procedures. Pakistan Armed Forces Medical Journal. 2025 Nov 30;75:S1140.
3. Kabir T, Khan N, Jabeen S, Kamal M, Mehmood A, Amin A. Incidence of postoperative wound infection in diabetic versus non-diabetic patients following clean surgical procedures: a cross-sectional study. J Rehman Med Inst. 2025;12:54-60.
4. Islam MR, Mahalder MA, Raman MS, Abedin MJ, Karim R. Comparative Study of perative Complications in Diabetic and Non-Diabetic Patients: A Prospective Study. The Planet. 2022 Aug 15;6(01):167-73.
5. Scherer M, Soldevila-Boixader L, Altorfer FC, Furrer PR, Beeler S, Wirth SH, Viehöfer A, Uçkay İ. Therapy for Non-Diabetic Foot Infections After Orthopedic Foot and Ankle Surgery: The Duration of Post-Debridement Antibiotic Treatment Does Not Alter Failure Risk. Life. 2024 Nov 20;14(11):1509.
6. Ahamad FU, Hassan MM, Khan MA, Fatema MB, Habib MA, Das PK, Hakim HN, Tani SA. Comparison of Postoperative Wound Infection in Controlled Diabetic and Non-Diabetic Patients in Elective Operations. Journal of Dhaka Medical College. 2022;31(2):226-31.
7. Węgłowski R, Borowski B, Bronikowska A, Piech P, Staśkiewicz G, Jarecki J. The Role of Metabolic Disorders and Laboratory Abnormalities in Wound Healing and Recovery in Geriatric and Non-Geriatric Orthopedic Patients in Poland—Prospective Research. Journal of Clinical Medicine. 2025 Jul 28;14(15):5317.
8. Lavery LA, Suludere MA, Ryan E, Crisologo PA, Tarricone A, Malone M, Oz OK. The infected diabetic foot: analysis of diabetic and non-diabetic foot infections. Wound Repair and Regeneration. 2024 Jul;32(4):360-5.
9. Diab J, O'Hara J, Pye M, Parker C, Maitz PK, Issler-Fisher A. Foot burns: a comparative analysis of diabetic and non-diabetic patients. Burns. 2021 May 1;47(3):705-13.
10. Lim SH, Tunku Ahmad TS, Devarajooh C, Gunasagaran J. Upper limb infections: A comparison between diabetic and non-diabetic patients. Journal of Orthopaedic Surgery. 2022 Jan 24;30(1):23094990221075376.