

SKIN AS A WINDOW TO DIABETES: A STUDY OF CUTANEOUS MANIFESTATIONS IN DIABETIC PATIENTS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: Diabetes mellitus is a common metabolic disorder associated with a broad spectrum of cutaneous manifestations. Skin findings may serve as important clinical indicators of underlying diabetes and its complications. Certain dermatological conditions, including recurrent bacterial infections, xerosis, and candidal balanitis, may facilitate early diagnosis, while autoimmune dermatoses such as vitiligo and alopecia areata are more frequently associated with type 1 diabetes mellitus. **Objective:** To evaluate the pattern and prevalence of cutaneous manifestations in patients with diabetes mellitus and to assess their clinical significance. **Materials and Methods:** This cross-sectional observational study included 251 diabetic patients (159 males and 92 females) attending the Dermatology Outpatient Department. A detailed history and comprehensive dermatological examination were performed, and the findings were systematically recorded and analysed. **Results:** Cutaneous manifestations were frequently encountered among diabetic patients. Bacterial infections constituted the most common infectious dermatoses, highlighting the increased susceptibility of diabetic individuals to skin infections. Among non-infectious conditions, xerosis and acanthosis nigricans were the predominant findings. **Conclusion:** Bacterial infections, xerosis, and acanthosis nigricans were the most frequently observed cutaneous manifestations in patients with diabetes mellitus. Recognition of these dermatological markers may aid in the early detection of diabetes, assessment of disease control, and prompt initiation of appropriate management strategies.

INTRODUCTION

Diabetes mellitus (DM) is one of the most prevalent endocrine and metabolic disorders worldwide, affecting approximately 9.3% of the global population.^[1] It is characterized by chronic hyperglycaemia resulting from defects in insulin secretion, insulin action, or both.^[2] Broadly, diabetes is classified into type 1 and type 2 diabetes mellitus. Persistent hyperglycaemia leads to biochemical, structural, and functional alterations in various tissues, resulting in multiple systemic complications.^[3]

The skin is frequently affected in patients with diabetes mellitus, with cutaneous manifestations reported in nearly one-third of affected individuals worldwide and in 43–66% of diabetic patients in India.^[4] These manifestations may arise due to metabolic disturbances, vascular insufficiency, neuropathy, impaired immune responses, or

treatment-related factors. A wide spectrum of dermatological conditions has been associated with diabetes, ranging from infectious dermatoses to specific cutaneous markers such as xerosis, acanthosis nigricans, and diabetic dermopathy. Cutaneous manifestations often develop throughout the course of diabetes; however, they may occasionally precede the diagnosis and serve as the first clinical clue to underlying disease.^[5] Therefore, dermatologists play a crucial role in the early detection of undiagnosed diabetes and its complications. Recognizing these skin findings can facilitate timely diagnosis, appropriate intervention, and improved patient outcomes.

MATERIALS AND METHODS

This hospital-based study on the pattern and prevalence of cutaneous manifestations in patients with diabetes mellitus and to assess their clinical

significance was carried out in the Department of Dermatology, Venereology & Leprosy, Venkateshwara Institute of Medical Sciences, Gajraula, over a one-year period from March 2025 to March 2026. The study protocol was reviewed and approved by the Institutional Ethics Committee before initiation of the study.

Study plan Cross sectional observational study

Inclusion Criteria

- Both genders of patients.
 - Patients between the ages of 14 and 80.
 - Study participants who are willing to participate.
 - Diabetic patients who meet American Diabetes Association standards.
1. A1C \geq 6.5%. The test should be performed in a laboratory using a method that is NGSP certified and standardized to the DCCT assay.

OR

2. FPG \geq 126 mg/dl (7.0 mmol/l). Fasting is defined as no caloric intake for at least 8 h. OR
3. 2-h plasma glucose \geq 200 mg/dl (11.1 mmol/l) during an OGTT. The test should be performed as described by the World Health Organization, using a glucose load containing the equivalent of 75 g anhydrous glucose dissolved in water. OR
4. In a patient with classic symptoms of hyperglycaemia or hyperglycaemic crisis, a random plasma glucose \geq 200 mg/dl (11.1 mmol/l).

Exclusion Criteria

Patients with iatrogenic causes, other systemic disorders, or skin abnormalities brought on by pregnancy were excluded.

Methodology

This cross-sectional observational study was conducted in the Department of Dermatology, Venereology & Leprosy at Venkateshwara Institute of Medical Sciences, Gajraula, from March 2025 to March 2026. Patients with diabetes mellitus attending the Dermatology Outpatient Department and fulfilling the inclusion and exclusion criteria were enrolled in the study. A detailed clinical history was obtained from all participants. This was followed by comprehensive general, systemic, and dermatological examinations, and the cutaneous manifestations were diagnosed clinically. Glycemic status was assessed using fasting blood sugar (FBS) and random blood sugar (RBS) levels. Additional relevant laboratory investigations were performed whenever indicated. In patients with suspected bacterial skin infections, pus culture and sensitivity testing was carried out, and only culture-positive cases were included in the analysis.

Statistical Analysis

Data were collected, tabulated, and analysed using Statistical Package for the Social Sciences (SPSS) version 22.0. Categorical variables were expressed as frequencies and percentages. The Chi-square test was used to assess the association between cutaneous manifestations, glycaemic control, and gender. A p-value of <0.05 was considered statistically significant.

RESULTS

Table 1: Distribution of patients according to duration of diabetes

Duration of diabetes	No of patients	Percentage (%)
\leq 5 years	222	88.45
6 to 10 years	22	8.76
11 to 15 years	3	1.20
16 to 20 years	3	1.20
$>$ 20 years	1	0.40
Total	251	100
Mean \pm SD	3.19 \pm 3.22(8mth-25 years)	

Table 2: Cutaneous infections among the study population

Cutaneous manifestations	No. of patients	Percentage (%)
Bacterial	133	52.99%
Fungal	25	9.96%
Viral	2	0.80%
Total	160	63.75%

Table 3: Distribution of patients according to non- infectious cutaneous manifestations

Noninfectious Condition	No of patients	Percentage (%)
Xerosis	65	25.9%
Acanthosis Nigricans	27	10.76%
Diabetic Foot	14	5.58%
Skin Tag	12	4.78%
Vitiligo	7	2.79%
Acne Keloidalis Nuchae	5	1.99%
Pruritus	5	1.99%
Xanthelasma Palpebrarum	5	1.99%

Non-Healing Ulcer	3	1.2%
Lichen Planus	3	1.2%
Pemphigus Vulgaris	2	0.8%
Psoriasis	2	0.8%
Diabetic Bullae	1	0.4%
Diabetic Thick Skin	1	0.4%
Granuloma Annulare	1	0.4%
Total	153	58.99%

Table 4: Distribution of patients with infectious cutaneous manifestations in diabetes

Infections	Diagnosis	No of patients	%
Bacterial	Folliculitis	65	25.9
	Cellulitis	3	1.2
	Pyoderma	3	1.2
	Ecthyma	2	0.8
	Erythrasma	2	0.8
	Intertrigo	2	0.8
	Carbuncle	1	0.4
	Furuncle	1	0.4
	Total	133	52.99
	Fungal	Tinea cruris	11
Tinea corporis		38	15.14
Candial balanitis		9	3.59
Vaginal candidiasis		6	2.39
Oral candidiasis		4	1.59
P.versicolor		3	1.2
Intertrigo		2	0.8
Tinea pedis		2	0.8
Tinea faciei		2	0.8
Candidal balanoposthitis		1	0.4
Viral	Candidal intertrigo	1	0.4
	Total	25	9.96
	Herpes zoster	2	0.8
Overall Total	Total	2	0.80
	Total	160	63.75

Table 5: Distribution of patients according to FBS Level

FBS (Mg%)	No of patients	Percentage (%)
Normal (70-110)	28	11.16
Abnormal (>110)	223	88.84
Total	251	100.00
Mean FBS ±SD	180.96 ± 73.40(72-482)	

Table 6: Distribution of patients according to PMBS (post meal blood sugar)

PMBS(Mg%)	No of patients	Percentage (%)
Hypoglycemic (<120)	3	1.20
Normal (120-140)	3	1.20
Abnormal (>140)	245	97.61
Total	251	100
Mean PMBS±SD	260.04±86.50(92-576)	

Among the 251 study participants, the majority (88.45%) had a duration of diabetes of less than 5 years, followed by 8.76% with a duration of 6–10 years. Only a small proportion of patients had diabetes for more than 10 years.

Infectious dermatoses were common among diabetic patients, with bacterial infections being the most frequent, affecting 52.99% of patients, followed by fungal infections (9.96%) and viral infections (0.80%).

Among non-infectious cutaneous manifestations, xerosis was the most common finding, observed in

25.9% of patients, followed by acanthosis nigricans (10.76%), diabetic foot (5.58%), and skin tags (4.78%). Less frequent conditions included vitiligo, xanthelasma palpebrarum, pruritus, lichen planus, psoriasis, pemphigus vulgaris, diabetic bullae, diabetic thick skin, and granuloma annulare.

Among infectious dermatoses, folliculitis was the most prevalent lesion, affecting 25.9% of patients, followed by tinea corporis (15.14%), tinea cruris (4.38%), candidal balanitis (3.59%), and vaginal candidiasis (2.39%). Other less common infections included oral candidiasis, cellulitis, pyoderma,

ecthyma, furuncle, herpes zoster, intertrigo, carbuncle, erythrasma, and candidal intertrigo.

Assessment of glycaemic status revealed that 88.14% of patients had elevated fasting blood sugar levels (>110 mg/dL), while only 11.16% had values within the normal range. The mean fasting blood sugar level was 180.96 ± 73.40 mg/dL. Similarly, post-meal blood sugar levels were abnormal in 97.61% of patients, with a mean value of 260.04 ± 86.50 mg/dL, indicating poor glycaemic control in most of the study population.

DISCUSSION

In the present study, the majority of patients (88.45%) had a duration of diabetes of less than 5 years, while only 0.40% had diabetes for more than 20 years. Similar findings were reported by Nandini Chatterjee et al,^[7] where most patients had diabetes for 1–10 years. The duration of diabetes is clinically relevant, as prolonged disease duration has been associated with a higher risk of cutaneous complications and systemic morbidity. The importance for knowing the duration of diabetes was enlightened by Hattem et al. He emphasized that patients with long-standing diabetes are more likely to develop severe dermatological manifestations, although cutaneous adverse effects may also occur early due to insulin or oral hypoglycaemic therapy.

Infectious dermatoses constituted a major proportion of cutaneous manifestations in our study. Bacterial infections were the most common, affecting 52.99% of patients, followed by fungal (9.96%) and viral infections (0.80%). Similar observations were reported by Yoganand J. Phulari et al.,^[8] who found infectious dermatoses to be more prevalent than non-infectious conditions among diabetic patients. Chaurasia et al,^[9] reported bacterial infections as the most frequent cutaneous manifestation (24%), followed by fungal infections (22.7%) and acanthosis nigricans (20.4%), with a significant association between bacterial infections and poor glycaemic control. Ahmed et al,^[10] also observed a predominance of bacterial infections and reported lower frequencies of fungal and viral infections. Likewise, Al-Mutairi et al,^[11] found bacterial infections to be more common than dermatophytosis, candidiasis, and viral infections.

Mahajan et al,^[12] reported infections as the largest group of dermatological disorders in diabetic patients, highlighting the importance of bacterial infections as a common cutaneous manifestation of diabetes mellitus. In our study, the predominance of bacterial infections further supports the role of impaired immunity, altered host defense mechanisms, and poor glycaemic control in increasing susceptibility to bacterial skin diseases.

Among the non-infectious dermatoses, xerosis was the most common finding, affecting 25.9% of patients, followed by acanthosis nigricans (10.76%), diabetic foot (5.58%), and skin tags (4.78%). Stingeni

et al,^[13] reported xerosis as the most prevalent cutaneous manifestation, affecting 81.3% of patients with type 2 diabetes mellitus, emphasizing its importance as a significant dermatological marker of diabetes. Vishwanathan et al,^[14] similarly observed diabetic bullae as one of the least common non-infectious manifestations, with a prevalence of 0.5%, which is comparable to our findings.

Analysis of infectious dermatoses revealed that bacterial infections accounted for the majority of cases (53%), followed by fungal (9.98%) and viral infections (0.64%). Folliculitis was the most common infectious dermatosis in our study. These findings are consistent with previous studies that identified bacterial infections as the predominant skin disorder in diabetic patients and reinforce the need for early diagnosis and prompt treatment of bacterial skin infections in this population.

Assessment of glycaemic control demonstrated elevated fasting and post-meal blood sugar levels in the most patients. Abnormal post-meal blood sugar levels were observed in 97.6% of cases, indicating poor glycaemic control. Similar findings were reported by Srirath Kambil et al,^[15] who observed that cutaneous manifestations were more common among patients with unsatisfactory glycaemic control. The association between poor glycaemic control and increased frequency of cutaneous manifestations observed in our study further highlights the importance of strict metabolic control in reducing dermatological complications among diabetic patients.

Table 1 depicts that maximum number of patients i.e. 222(88.45%) had duration of <5years and least number of patients i.e. 1(0.40%) duration was >20years. Similarly, Nandini Chatterjee et al,^[7] reported that maximum number of patients i.e. 290 had diabetes for 1-10 years followed by 201<10 years & 12 patients were newly diagnosed cases of diabetes. So, the maximum patients i.e. 290 had diabetes from 1-10years.

The relevance for knowing the duration of diabetes was explained by Hattem et al. That patients who have had Diabetes for extended years tend to develop more catastrophic cutaneous problems. On the other hand, problems can develop in the short-range, as insulin and oral hypoglycaemic drugs can have cutaneous side effects.

Table 2 depicts the distribution of patients according to skin infection. Maximum number of patients i.e. 133(52.99%) bacterial, 25(9.96%) fungal and 2(0.80%) viral. Yoganand J. Phulari et al,^[8] reported that skin manifestations among the study population, where 61% had infectious skin manifestations and 39% had non-infectious. Chaurasia A et al,^[9] in their study on Cutaneous manifestations in Diabetic Patients and its Correlation with HbA1c Level stated that among 300 patients with type 2 diabetes mellitus, cutaneous manifestations were common, with bacterial infections emerging as the most frequent finding (24%), followed by fungal infections (22.7%) and acanthosis nigricans (20.4%). Notably, bacterial

infections showed a significant association with poor glycaemic control, highlighting the increased susceptibility of uncontrolled diabetic patients to skin infections. These findings emphasize the importance of early recognition and management of bacterial skin infections as a marker of inadequate diabetes control.

Ahmed et al,^[10] also reported Bacterial infections to be more common in their study. In our study frequency of fungal infections in uncontrolled diabetic group is almost similar to Bacterial infection but viral infection is relatively less common due to a smaller number of cases. They also claimed a lower frequency of Fungal and Viral infections.

Mahajan et al,^[12] in their study on Cutaneous manifestation of diabetes mellitus highlighted that cutaneous manifestations were observed in 64% of diabetic patients compared to 22% of controls. Infections constituted the largest group of skin disorders (35%), with bacterial infections accounting for 12% and fungal infections for 21% of cases. The high prevalence of bacterial infections highlights their importance as a common dermatological manifestation in patients with diabetes mellitus.

Al-Mutairi,^[11] also reported bacterial infection as more common than dermatophytes, candida, and viral.

Table 3 depicts the distribution of patients according to non-infectious conditions. In non-infectious conditions the greatest number of patients i.e. 65(25.9%) had xerosis and least were 2(0.8%) pemphigus vulgaris and psoriasis followed by 1(0.4%) diabetic bullae, diabetic thick skin and granuloma annulare. Xerosis emerged as the predominant cutaneous manifestation, affecting 81.3% of patients with type 2 diabetes mellitus. This prevalence was substantially higher than previously reported rates (26–44%), emphasizing xerosis as a common and clinically significant dermatological finding in diabetic patients, done in a study by Stingeni L et al,^[13] Vishwanathan et al,^[14] reported that non-infectious dermatoses with least percentage associated with diabetes mellitus noted were diabetic bullae (0.5%).

Table 4 depicts distribution of infectious conditions in diabetes in which maximum number of patients had bacterial infections 133(53%) followed by fungal 25 (9.98%) and viral (0.64%).

Chaurasia et al,^[9] and Ahmed et al,^[10] both reported bacterial infections as the most common cutaneous manifestation in patients with type 2 diabetes mellitus. Chaurasia et al. observed bacterial infections in 24% of patients and demonstrated a significant association with poor glycaemic control, emphasizing their role as a marker of uncontrolled diabetes. In our study, bacterial infections were also highly prevalent, although fungal infections occurred at a comparable frequency in the uncontrolled diabetic group, while viral infections were relatively uncommon.

Table 5 depicts the distribution of patients according to PMBS i.e. the greatest number of patients had

PMBS (>140) abnormal i.e. 245 (97.6%). Srirath Kambil et al,^[15] in their study examined 286 patients 172(60.13%) were males and 114(39.86%) females. The cutaneous lesions were more common in patients with unsatisfactory glycaemic control.

Table 6 depicts the distribution of patients according to PMBS i.e. the greatest number of patients had PMBS (>140) abnormal i.e. 245 (97.6%). Srirath Kambil et al (2017),^[15] in their study examined 286 patients 172 (60.13%) were males and 114(39.86%) females. The cutaneous lesions were more common in patients with unsatisfactory glycaemic control. In the above study also fasting blood sugar level and post meal blood sugar level both were raised.

CONCLUSION

Based on our findings, bacterial infections emerged as one of the most common cutaneous manifestations of diabetes mellitus and were frequently associated with poor glycaemic control. Therefore, elderly patients presenting with recurrent or unexplained bacterial skin infections, particularly in the presence of xerosis, should be evaluated for underlying diabetes mellitus. Early recognition of these dermatological markers can facilitate timely diagnosis and intervention. Furthermore, optimal management of diabetic patients with cutaneous manifestations requires a multidisciplinary approach involving close collaboration between dermatologists and physicians to ensure comprehensive care, improved glycaemic control, and better clinical outcomes.

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