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Cutaneous Manifestation in Children Patients with Type 1 Diabetes Mellitus

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Abstract: Background and Design: Type 1 diabetes mellitus (T1DM) can cause significant changes in the skin. However, there are limited studies examining skin findings in children with T1DM. This study aims to determine the frequency of skin lesions in children with T1DM and evaluate their relationship with disease duration and hemoglobin A1c (HbA1c) levels.

Materials and Methods: the study was including 49 children with diabetes mellitus type 1 and 60 age- and sex-matched healthy children. The children were examined in detail by a pediatrician and dermatologist .

Results: Children's age at beginning of the diabetes was 7.0 ± 3.5 years, and duration of illness was 49.8 ± 38.7 months. The average of HbA1c was 8.2 ± 1.7%.

Out of the total of 49 subjects in the study, 9 (18.4%) used an insulin pump, and 40 (81.6%) used multiple daily injections of insulin. In 41 patients (83.7%) at least one associated skin condition caused by insulin. The most common adverse effects were lipohypertrophy, ecchymosis and post-inflammatory hyperpigmentation. Patients with diabetes type 1 were more likely to have occurrences of xerosis and rubeosis faciei compared to controls which were statistically significant 28.6%vs. 10.0% and 10.2%versus 1.7% respectively. Facial erythema patients showed higher body mass index (BMI) levels..

Conclusion: Training patients and caregivers and increasing physician awareness can improve management and prevention of skin findings in children with T1DM.

Keywords: Children, insulin, lipodystrophy, type 1 diabetes mellitus

Introduction

Type 1 diabetes is when your pancreas makes no insulin at all and it almost always requires an external source of insulin. You'll have to take an injection every day to keep your blood sugar levels normal. Diagnosis of the condition can be made at any age; however, it is a most common chronic disease of childhood. The estimates of general incidence and prevalence in our country among those less than eighteen years was approximately 12.3 per 100000 and 0.85 per 1000 respectively(1,2). The incidence and prevalence of disease are rising globally. Between 2013 and 2020, a recent regional study showed an annual increase of T1DM cases among children. (3,4).

Skin changes are common manifestations of diabetes mellitus, arising from abnormal carbohydrate metabolism, microangiopathy, and impaired host defenses. Children with T1DM frequently develop autoimmune-related cutaneous lesions(5) However, studies on skin manifestations in children with T1DM are limited, especially in our region.

This cross-sectional study aims to determine the frequency of skin lesions in children with T1DM compared with healthy controls and evaluate relationships with disease duration and HbA1c levels.

Materials and Methods

This study included 49 children with T1DM followed in the Pediatric Endocrinology outpatient clinic between June 2021 to December 2024 and 60 age- and sex-matched healthy non-obese controls. informed consent was obtained from all participants.

Detailed skin examinations were conducted by a single dermatologist. Wood's lamp and mycological tests were used as needed. Demographic data, routine HbA1c values, and disease-related information were collected.

Statistical Analysis

Data were analyzed using SPSS version 18. Descriptive statistics, chi-square tests, and t-tests were used. A p-value < 0.05 was considered statistically significant.

Results

Among the 49 children with T1DM, 32 (65.3%) were female and 17 (34.7%) male. The control group included 39 females (65.0%) and 21 males (35.0%). The mean age was 11.1 ± 3.3 years in the T1DM group and 10.0 ± 3.8 years in controls, with no significant differences in age or gender.

The disease began on an average age of 7.0 years ± 3.5 years with mean duration of the disease 49.8 months ± 38.7 months. Average HbA1c Level Was 8.2 ± 1.7%. In the T1DM group, there were 10 (20.4%) obese patients but none in the controls. BMI and BMI percentile of T1DM patients was significantly higher (p<0.05). Table 1 has the characteristics related to BMI.

Table 1 : BMI-related Characteristics

Characteristic	T1DM Patients (n=49)	Healthy Controls (n=60)	p-value
Mean ± SD for BMI (kg/m²)	20.5 ± 4.8	17.9 ± 3.2	<0.001
Percentile of BMI (mean ± SD)	66.1 ± 25.6	42.3 ± 23.9	<0.001
Obesity (n (%))	10 (20.4%)	0 (0%)	<0.001

Table 2 provides an overview of the skin reactions that occurred due to insulin therapy. There was no significant association between lipohypertrophy with duration of the disease and levels of HbA1c.

Of the total 49 patients, 40 patients (81.63%) used multiple daily injection and 9 (18.4%) used an insulin pump . Out of the total patients, 41 (83.7%) had skin lesions related to insulin. Lipohypertrophy (44.9%) was the second most common complaint after bruising (51.0%). Of the 9 patients using insulin pumps, 5(55.6%) had hypopigmented scars.

Table 2 : skin reactions associated with insulin therapy.

Skin Lesion	Insulin Therapy (n=49)	Multiple Daily Injections (n=40)	Insulin Pump Therapy (n=9)
Lipohypertrophy	22 (44.9%)	20(50%)	2(22.2%)
Lipoatrophy	0 (0%)	0 (0%)	0 (0%)
Post-inflammatory	13 (26.5%)	10(25%)	3 (33.3%)

hyperpigmentation			
Scar (hypopigmented)	5 (10.2%)	0 (0%)	5 (55.6%)
Erythema	0 (0%)	0 (0%)	0 (0%)
Bulla	0 (0%)	0 (0%)	0 (0%)
Local infection	0 (0%)	0 (0%)	0 (0%)
Bruise	25 (51.0%)	25(62.5%)	0 (0%)
Insulin pump-related contact dermatitis	1 (2.0%)	0 (0%)	1 (11.1%)

T1DM patients had a significantly higher incidence of xerosis and rubeosis faciei diabeticorum than controls: xerosis in 14 (28.6%) vs 6 (10.0%) and rubeosis faciei in 5 (10.2%) vs 1 (1.7%) Details of skin findings in the patients and healthy controls is shown in Table 3. Patients with these conditions had a longer disease duration and higher HbA1c compared to patients without the condition but the differences were not significant. Patients with rubeosis faciei had a significantly higher BMI ($p < 0.05$). It was discovered that the duration of disease was longer and HbA1c levels were higher in T1DM patients with rubeosis faciei or xerosis; however, the difference was not statistically significant. Furthermore, the results indicated that T1DM patients with rubeosis faciei diabeticorum had a greater BMI than patients without rubeosis (Table 4).

Table 3. A comparison of skin symptoms in diabetes type 1 patients and controls..

Skin Condition	T1DM Patients (n=49)	Healthy Controls (n=60)	p-value
Folliculitis	10 (20.4%)	6 (10.0%)	0.058
Xerosis cutis	14 (28.6%)	6 (10.0%)	0.004
Rubeosis faciei diabeticorum	5 (10.2%)	1 (1.7%)	0.047
Vitiligo	1 (2.0%)	0 (0%)	0.455
Striae	10 (20.4%)	11 (18.3%)	0.908
Seborrheic dermatitis	6 (12.2%)	5 (8.3%)	0.355
Acne vulgaris	14 (28.6%)	16 (26.7%)	0.908

Table 4: Factors contributing to the diabetic facial erythema in children of type 1 diabetes.

Variable	Absent (n=44)	Present (n=5)	p-value
BMI (kg/m²)	19.84 ± 4.28	26.02 ± 5.98	0.002*
Duration of diabetes (months)	43.50 ± 39.58	70.00 ± 45.16	0.128
HbA1c (%)	8.07 ± 1.59.	8.33 ± 1.99	0.713

Table 5 Factors contributing to the xerosis cutis in children of type 1 diabetes.

Variable	Absent (n=35)	Present (n=14)	p-value
BMI (kg/m²)	21.03 ± 4.55	18.90 ± 5.02	0.100
Duration of diabetes (months)	41.30 ± 39.69	57.21 ± 41.22	0.151
HbA1c (%)	8.02 ± 1.68	8.27 ± 1.49	0.580

Discussion

Various skin findings—xerosis, rubeosis faciei diabeticorum, limited joint mobility, scleroderma-like changes, and infections—occur in T1DM patients [5,6]. Xerosis cutis is among the most common diabetes-related skin conditions [7,8], characterized by reduced stratum corneum hydration and decreased sebaceous activity despite intact barrier function [9].

Our study found xerosis in 28.6% of patients, consistent with previous reports. Unlike some studies showing correlation with HbA1c [10], we did not find a significant association, though patients with xerosis had higher HbA1c.

Rubeosis faciei, characterized by cheek erythema from small vessel dilation, was found in 10.2% of patients, slightly higher than prior reports (0–8.75%) [8,10–12]. Higher BMI was significantly associated with rubeosis faciei. While extracutaneous diabetic complications were not evaluated here, rubeosis faciei has been linked to nephropathy, neuropathy, and retinopathy [10,13].

Fungal infections were not observed, likely due to shorter disease duration and lower HbA1c compared to prior studies reporting fungal infections in 40% of children with longer disease duration [10].

Insulin therapy-related skin reactions such as lipohypertrophy (44.9%), bruises (51.0%), and post-inflammatory hyperpigmentation (26.5%) were common, consistent with reported ranges [14–17]. Lipohypertrophy prevalence varies widely but remains a significant concern.

Insulin pump-related complications differ from injection therapy. Scars under 3 mm are frequently reported as the most common lesion in pump users [14,18,19]. Consistently, scar formation was the most common lesion (55.6%) in pump users in our study. Other complications include erythema, nodules, eczema, and rare bruising [14,18–23]. One patient had contact dermatitis potentially related to the pump.

Study Limitations

Limitations include the cross-sectional design, short disease duration, relatively small sample size, and lack of evaluation of extracutaneous diabetic complications. Longitudinal studies with larger cohorts are needed.

Conclusion

Training patients, caregivers, and increasing physician awareness are crucial for preventing and managing skin complications in children with T1DM.

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