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**Dermatological Complications of Insulin Therapy in Children with Type 1 Diabetes: Cross-Sectional Study**

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***Background****. Dermatological complications of insulin therapy in children with type 1 diabetes (T1D) cause low patient retention to treatment, reduce insulin therapy (with injection pens and pumps) efficiency, limit the use of modern high-tech methods of glycemia monitoring.* ***Objective****. The aim of the study was to study the structure and risk factors of dermatological complications of insulin therapy in children with T1D.* ***Methods****. Children aged from 1 to 17 with T1D and their parents were interviewed using the questionnaire containing 28 questions about skin changes associated with insulin therapy or glycemia monitoring in the past and about injection techniques. Skin (local allergic and/or inflammation reactions) and subcutaneous fat (hypotrophy and hypertrophy) changes at injection, infusion set, catheter and sensor sites were estimated via patient examination. The structure of dermatological complications of insulin therapy and their correlation with injection technique, infusion pump sets installation and glycemia monitoring were analyzed.* ***Results****. The study has included 50 patients with median age of 12 years (10; 14), T1D duration of 4 years (3; 7). 32 patients have performed insulin injections via injection pens, others have used insulin pump therapy. Continuous glycemia monitoring via sensor-augmented pump was performed in 5 patients, flash glycemia monitoring — in 17 patients. Allergic reactions (urticarial-type) to insulin were reported in 4 (8%) cases. Signs of allergic contact dermatitis at the catheter/sensor site were revealed in 5/18 (28%) patients on insulin pump therapy (no rotation of infusion systems installation sites) and 10/22 (45%) patients on glycemia monitoring (3 with continuous glycemia monitoring, 7 with flash glycemia monitoring). Lipoatrophy was revealed in 1 patient (on insulin pump therapy), lipohypertrophy was revealed in 22 patients: 20/32 (63%) were using injection pens and 2/18 (11%) — insulin pump therapy. Lipohypertrophy was revealed more often on self-administration via injection pens (in all cases patients did not change the insulin injection site, the needle was replaced less than 1 time per day).* ***Conclusion****. Risk of dermatological complications in children with T1D is higher when the injection technique or infusion set installation is inappropriate.*

***Key words****: children, teenagers, type 1 diabetes, dermatological complications, allergic contact dermatitis, lipoatrophy, lipohypertrophy, injection pen, insulin pump therapy, continuous glycemia monitoring, flash glycemia monitoring, risk factors.*

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**RESULTS**

**Table 1.** Insulin injections and infusion sets for insulin pumps installation in children with T1D

|  |  |  |
| --- | --- | --- |
| **Indicators** | **Injection pens**  ***n* = 32, abs. (%)** | **Insulin pumps**  ***n* = 18, abs. (%)** |
| *Site*:   * abdomen * hip * shoulder * buttock | 25 (78)  24 (75)  23 (72)  13 (41) | 15 (83)  2 (11)  2 (11)  13 (72) |
| *Self-dependence*:   * self-administration * under adults’ control * only by adults | 16 (50)  12 (38)  4 (13) | 7 (39)  5 (28)  6 (33) |
| *Sites rotation*:   * frequently * not always * never | 15 (47)  13 (41)  4 (13) | 13 (72)  2 (11)  3 (17) |
| *Replacement of needles/infusion sets*:   * before every injection * at least once per day * less than once per day * every 2 days * every 3 days * every 4 days and rarely | 3 (9)  14 (44)  15 (47)  -  -  - | -  -  -  1 (6)  9 (50)  8 (44) |

**Table 2.** Local inflammation reactions of the skin in patients with T1D on insulin pump therapy in relation to the infusion system installation

|  |  |
| --- | --- |
| **Indicators** | **Frequency, abs. (%)** |
| *Site*:   * abdomen (*n* = 15) * hip (*n* = 2) * shoulder (*n* = 2) * buttock (*n* = 13) | 3 (20)  -  -  2 (15) |
| *Self-replacement*:   * self-administration (*n* = 7) * under adults’ control (*n* = 5) * only by adults (*n* = 6) | 1 (14)  3 (60)  1 (17) |
| *Replacement frequency*:   * every 2 days (*n* = 1) * every 3 days (*n* = 9) * ≥ than every 4 days (*n* = 8) | -  3 (33)  2 (25) |
| *Sites rotation*:   * frequently (*n* = 13) * not always (*n* = 2) * never (*n* = 3) | -  2 (100)  3 (100) |

**Table 3.** Lipohypertrophy of subcutaneous fat in patients with T1D using injection pens in relation to the injection site and technique

|  |  |
| --- | --- |
| **Indicators** | **Frequency, abs. (%)** |
| *Lipohypertrophy place*: | |
| * abdomen (*n* = 25) | 17 (68) |
| * hip (*n* = 24) | 9 (38) |
| * shoulder (*n* = 23) | 4 (17) |
| * buttock (*n* = 13) | 5 (38) |
| *Self-dependence*: | |
| * self-administration (*n* = 16) | 11 (69) |
| * under adults’ control (*n* = 12) | 7 (58) |
| * only by adults (*n* = 4) | 2 (50) |
| *Sites rotation*: | |
| * frequently (*n* = 15) | 10 (67) |
| * not always (*n* = 13) | 6 (46) |
| * never (*n* = 4) | 4 (100) |
| *Replacement frequency*: | |
| * before every injection (*n* = 3) | 1 (33) |
| * at least once per day (*n* = 14) | 6 (44) |
| * less than once per day (*n* = 15) | 13 (87) |

**STUDY LIMITATIONS**

A small number of patients was included in the study. In this regard, it should be noted that the small sample size allows to characterize only the most common dermatological complications. The inclusion of only hospitalised patients to the study (hospitalisation is usually due to the decompensation) can exaggerate the frequency of complications, while exclusion of those who refuse to fill up the questionnaire (non-compliant patients) can underrate its frequency.

We should mention among the research limitations that anamnestic evaluation of allergic reactions to insulin administration and local inflammation reactions at using of insulin pump therapy or glycemia monitoring devices can confound detection rate of such complications (patients and their parents may forget to mention, or not to consider skin changes as complications, or on the contrary wrongly connect skin changes to insulin therapy/monitoring).

Examination of patients in order to detect dermatological complications was carried out by one researcher. That also could lead to results distortion due to subjective assessment. There was no study on the reproducibility of such assessment.

**FINANCING SOURCE**

Not specified.

**CONFLICT OF INTERESTS**

Not declared.