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Dermatoglyphic Forensic Diagnosis of Type 1 Diabetes Mellitus in Children

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Abstract: This article highlights the forensic and diagnostic significance of dermatoglyphics in identifying type 1 diabetes mellitus (T1DM) in children. The autoimmune mechanism and genetic factors of T1DM, as well as the correlation of dermatoglyphic markers with the disease, are analyzed. Recent studies conducted on the Uzbek population comparing dermatoglyphic indicators of children with T1DM and healthy controls are presented. As a non-invasive, rapid, and cost-effective method, dermatoglyphics has high value in both clinical and forensic medicine.

Key words: Dermatoglyphics, type 1 diabetes mellitus, forensic diagnosis, pediatric endocrinology, genetic markers, ATD angle, ridge count.

Introduction

Type 1 diabetes mellitus (T1DM) is the most common endocrine pathology among children, characterized by complete insulin dependence. According to the International Diabetes Federation (IDF), in 2024 more than 1.1 million children under the age of 18 worldwide are living with T1DM. In Uzbekistan, the incidence has increased 1.7-fold over the past decade.

Genetic predisposition plays a key role in the development of T1DM. Dermatoglyphics, being strictly genetically determined, is widely used as an auxiliary marker in early diagnosis. Papillary ridges on fingertips are formed during the 3rd–5th months of fetal development and remain unchanged throughout life, making them a "genetic passport." This feature increases the diagnostic and forensic value of dermatoglyphics.

Main Part

1. Genetic basis of dermatoglyphics

Dermatoglyphic patterns are controlled by a complex polygenic system transmitted via autosomes. In T1DM, genetic associations with HLA-DR3 and HLA-DR4 alleles have been identified. Dermatoglyphic markers show correlations with these genetic determinants, thus serving as signal indicators for identifying children at risk of T1DM.

2. Dermatoglyphic changes observed in children with T1DM

Studies conducted in Uzbekistan, Kazakhstan, Russia, and India revealed:

- **Ridge Count** (number of lines on the fingertip) is reduced by 12–18% in T1DM children compared to healthy controls.

- **ATD angle** (palmar triradial angle) is 55°–65° in T1DM children versus 38°–45° in healthy individuals.
- **Pattern Type Distribution**: Increased ulnar loops (1.4 times higher) and reduced whorl patterns in T1DM children.
- Palmar triradial asymmetry observed in 62% of T1DM children (25% in controls).
- Dermatoglyphic asymmetry of plantar patterns is also reported.

3. Studies on the Uzbek population

A study conducted at Tashkent State Medical University (2022–2023):

- 80 children with T1DM (aged 6–15) and 80 healthy controls were examined.
- The mean **Total Ridge Count (TRC)** was 123 ± 14 in T1DM group vs. 152 ± 11 in controls.
- The mean **ATD angle** was 59.2° ± 2.3° in T1DM children vs. 43.5° ± 1.8° in controls.
- 74% of T1DM children exhibited at least 3 dermatoglyphic markers.

4. Forensic diagnostic significance

Dermatoglyphics helps to:

- Confirm the hereditary basis of the disease in forensic examinations;
- Assess individual genetic predisposition to T1DM;
- Identify at-risk groups in screening programs;
- Monitor children with a family history of T1DM.

The method's non-invasive, rapid, and inexpensive nature makes it a valuable tool for pediatrics and forensic medicine.

5. Clinical application prospects

- Dermatoglyphic screening programs for high-risk children;
- Combined diagnostic protocols with genetic markers;
- Development of personalized prevention strategies;
- Use of dermatoglyphic maps in forensic examinations to establish hereditary components.

Conclusion

Dermatoglyphics is a valuable method for early detection of T1DM in children, assessing genetic predisposition, and providing evidence in forensic medicine. Studies on the Uzbek population confirm its practical significance. Identifying at-risk groups via dermatoglyphic markers can aid in early prevention and reduce complications associated with T1DM in children.

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