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Forensic-Medical Diagnosis of Type 1 Diabetes in Children Based on Dermatoglyphics

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Abstract: Type 1 diabetes mellitus (T1DM) is one of the most common endocrine diseases in children. Genetic factors play a leading role in the pathogenesis of this disease. Early detection of genetic predisposition is crucial for pediatrics, endocrinology, and forensic medical examination. Dermatoglyphics, the study of fingerprint and palmar skin ridge patterns, is a reliable method for diagnosing hereditary diseases. This article outlines the scientific basis, clinical observations, and practical importance of diagnosing type 1 diabetes in children using dermatoglyphic methods.

Keywords: Type 1 diabetes mellitus, dermatoglyphics, forensic diagnosis, pediatrics, genetic predisposition, ATD angle, dermatoglyphic index.

Introduction

Type 1 diabetes mellitus (T1DM) is a chronic endocrine disease caused by autoimmune destruction of insulin-producing β-cells. It is prevalent among children and is characterized by the difficulty of early diagnosis. According to the World Health Organization (WHO), approximately 500,000 new cases of T1DM are diagnosed in children worldwide each year. According to statistics from the Ministry of Health of the Republic of Uzbekistan, the incidence of T1DM among children has increased by 1.5 times over the past 10 years.

Dermatoglyphics is the science that studies skin ridge patterns formed during the prenatal period, under strict genetic control, and remaining unchanged throughout life. These patterns develop between the 3rd and 4th months of fetal development, making dermatoglyphic traits important markers in identifying genetic diseases. Studying dermatoglyphic features associated with T1DM is relevant for both pediatrics and forensic medical practice.

Main Part

1. Forensic-Medical Significance of Dermatoglyphics

Dermatoglyphic patterns are formed under genetic control and are minimally influenced by external environmental factors, making them reliable markers of hereditary diseases. In children with T1DM, the following features are commonly observed:

- ✓ Increased frequency of **ulnar loop** patterns on fingers
- ✓ Decreased **radial loop** patterns
- ✓ Rare occurrence of **arch** patterns
- ✓ **Enlarged ATD angle** on the palm (greater than 50°)

In forensic medical practice, these features serve as additional diagnostic criteria for identifying genetic predisposition.

2. Genetic Background

Genes such as **HLA-DR3** and **HLA-DR4** play a critical role in the development of T1DM. Research shows:

- ✓ Individuals with **HLA-DR3** tend to have more **ulnar loop** patterns
- ✓ Those with **HLA-DR4** show a **wider ATD angle**
- ✓ A **dermatoglyphic index** in the range of 14–16 indicates a higher risk of T1DM

3. Clinical Observations

- ➢ **Case 1**: An 8-year-old child diagnosed with T1DM. Dermatoglyphic analysis showed ulnar loop patterns on 70% of fingers and an ATD angle of 54°. Similar patterns in parents suggest a genetic predisposition.
- ➢ **Case 2**: A 12-year-old girl had a dermatoglyphic analysis before the onset of disease, showing an ATD angle of 55° and a high dermatoglyphic index. She developed diabetes within a year.
- ➢ **Case 3**: A healthy 10-year-old child with predominantly radial loops and an ATD angle of 42°. No development of diabetes over two years of observation.

These findings confirm that dermatoglyphic traits can be used to identify risk groups.

4. Practical Applications

Dermatoglyphic analysis is:

- ✓ **Non-invasive**, low-cost, and rapid
- ✓ Suitable for **early diagnosis** in children
- ✓ An **additional marker** for evaluating hereditary diseases in forensic-medical examinations

Conclusion

Dermatoglyphics is an effective method for the early diagnosis and forensic evaluation of type 1 diabetes mellitus in children. A higher frequency of ulnar loops, a wider ATD angle, and elevated dermatoglyphic indices indicate genetic predisposition. Implementing this method in pediatric and forensic medical practice in Uzbekistan can improve the early detection and management of T1DM.

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