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Assessment of Late Ventricular Potentials in Children with Type 1 Diabetes Mellitus

Laman Sultanova*[1], Nabat Aghayeva[2], Azad Akberzade[2]

[1]Azerbaijan Medical University, META Pediatric Endocrinoloogy Center, Baku, Azerbaijan, [2]META Pediatric Endocrinology Center, BAKU, Azerbaijan

Type 1 diabetes mellitus (T1DM) is a significant endocrine pathology in children, characterized by an increasing incidence. Numerous studies highlight the high risk of severe complications in T1DM, with cardiovascular impairments being among the most critical, often leading to fatal outcomes. One of the key complications is cardiac autonomic neuropathy (CAN), which increases the risk of fatal arrhythmias. Identifying reliable markers for predicting such risks is crucial for early intervention.

This study aimed to evaluate the parameters characterizing late ventricular potentials (LVPs) in young school-age children with T1DM. A total of 56 children aged 6–11 years were examined, including 36 T1DM patients (19 girls, 17 boys) and 20 healthy controls (10 girls, 10 boys). The T1DM group was subdivided into two subgroups based on disease duration:

- Group A (n=22): Disease duration of 1–3 years (mean duration: 1.82±0.22 years)
- Group B (n=14): Disease duration of 4 years or more (mean duration: 5.3±0.29 years)

All participants underwent a signal-averaged electrocardiography (SAECG) examination using a 12-channel “ECGlab” device, recording LVPs in the terminal part of the QRS complex and the early ST segment. The following SAECG parameters were assessed using Simpson’s method:

- TotQRSf (ms): Duration of the filtered QRS complex
- LAS40 (ms): Duration of low-amplitude (<40 µV) signals at the QRS terminal
- RMS40 (µV): Root-mean-square amplitude of the last 40 ms of the filtered QRS complex
- TotQRS/RMS40 ratio

Results:
The findings revealed significant LVP alterations in T1DM children compared to healthy controls. In Group A, TotQRS was 6.0% higher, and LAS40 was 19.6% higher ($p<0.01$) than in controls. Conversely, RMS40 was 9.5% lower ($p<0.001$), leading to an increased TotQRS/RMS40 ratio. In Group B, the changes were even more pronounced: TotQRS was 12.8% higher, LAS40 was 38.7% higher ($p<0.001$), and RMS40 was 25.6% lower ($p<0.001$) compared to healthy children. Statistical analysis confirmed that all parameters in Group B significantly differed not only from controls but also from Group A ($p<0.001$).

Conclusion:

The observed changes in LVP parameters indicate increased myocardial electrical instability in children with T1DM, particularly as disease duration increases. This suggests a higher risk of ventricular arrhythmias and sudden cardiac death. The findings underscore the necessity of routine LVP assessment via SAECG for early detection and risk stratification in T1DM patients. Given its non-invasive nature, LVP monitoring should be integrated into clinical practice to improve the long-term prognosis and reduce cardiovascular complications in children with T1DM.

Disclosure of interest: None declared