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ORIGINAL ARTICLE

Hypoglycemia-Related Electroencephalogram Changes Are Independent of Gender, Age, Duration of Diabetes, and Awareness Status in Type 1 Diabetes

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Abstract

Introduction:

Neuroglycopenia in type 1 diabetes mellitus (T1DM) results in reduced cognition, unconsciousness, seizures, and possible death. Characteristic changes in the electroencephalogram (EEG) can be detected even in the initial stages. This may constitute a basis for a hypoglycemia alarm device. The aim of the present study was to explore the characteristics of the EEG differentiating normoglycemia and hypoglycemia and to elucidate potential group differences.

Methods:

We pooled data from experiments in T1DM where EEG was available during both normoglycemia and hypoglycemia for each subject. Temporal EEG was analyzed by quantitative electroencephalogram (qEEG) analysis with respect to absolute amplitude and centroid frequency of the delta, theta, alpha, and beta bands, and the peak frequency of the unified theta–alpha band. To elucidate possible group differences, data were subsequently stratified by age group (± 50 years), gender, duration of diabetes (± 20 years), and hypoglycemia awareness status (normal/impaired awareness of hypoglycemia).

Results:

An increase in the log amplitude of the delta, theta, and alpha band and a decrease in the alpha band centroid frequency and the peak frequency of the unified theta–alpha band constituted the most significant hypoglycemia indicators (all $p < .0001$). The size of these qEEG changes remained stable across all strata.

Conclusions:

Hypoglycemia-associated EEG changes remain stable across age group, gender, duration of diabetes, and hypoglycemia awareness status. This indicates that it may be possible to establish a general algorithm for hypoglycemia detection based on EEG measures.

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Abbreviations: (EEG) electroencephalogram, (qEEG) quantitative electroencephalogram, (T1DM) type 1 diabetes mellitus

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