Auditory Evoked Cortical Potentials in Children with Severe Language Impairment

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Development of normal speech and language functions is closely related to normal hearing. However, most children with delayed or disturbed speech development show normal tone thresholds and here the investigation has to include higher levels in the auditory system. There is evidence for a connection between language impairment and a central auditory processing disorder, but the underlying mechanisms are not well understood. There is also a need for objective diagnostic methods of central auditory function.

In the present study, a computerized method of mapping the scalp topography of long-latency (cortical) auditory evoked potentials (LAEP) was used for assessment of the function in central auditory pathways. Topographic mapping of the LAEP component N1, in adults and normal children, showed reproducible and valid results. In adults, a focal negativity, focus of N1 (FNI), with a frontocentral position and contralateral to the stimulated ear was observed. The N1 maps in normal children showed a pattern similar to that in adults, but with some age-related changes. The N1 latencies declined significantly with age in normal children and reached adult values at the ages of 14-16 years.

The topography of the LAEP components N1, P2, N2 and the T complex was investigated in 20 children with severe language impairment (LI). The study also included auditory brainstem responses (ABR), electroencephalography (EEG), quantitative EEG (qEEG) and magnetic resonance imaging (MRI). Twenty normal children served as controls (C).

A similar topographic pattern was found in the LI and the C children, but with a higher proportion of deviating and non-focal maps in the LI group. The latencies of all components were significantly longer in the LI than in the C children. The diagnostic value of LAEP topography, latency and amplitude was estimated with a scoring system, whereby significantly higher scores were found in the LI group than in the C group. With all three parameters together the sensitivity was 65%, with a specificity of 90%.

There was a high degree of pathological EEGs in the LI group. ABR abnormalities were seen in some LI subjects. MRI was normal in all but two LI children. There was no significant correlation between the results of EEG, ABR, MRI and the total score of LAEP, but some LI children showed a wide pathological pattern. In 17 of the 20 LI subjects a pathological result was obtained in one or more of the investigations.
In conclusion, our results may indicate that language impairment has a dual pathophysiology, a specific auditory disorder (LAEP, ABR) and a non-specific general cerebral disturbance (EEG, MRI). The highly varying results among the present LI children, with specific and/or non-specific deviations, may be due to heterogeneity of the group with different aetiologies of their language impairment, or to a general developmental disturbance with a varying distribution and penetrance. The scoring system of LAEP proved to be the most sensitive method in separating the LI children from the controls. This may be a promising model for individual diagnostic criteria and for classification of language impairment.