Auditory Brainstem Responses in a passive oddball paradigm

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Résumé

The auditory evoked potential (AEP) objectively examines the auditory pathway from the brainstem to the cortex. AEP studies indicate that infrequent deviant sounds reliably elicit a negative potential approximately 100-300 ms after the stimulus onset called mismatch negativity (MMN) response, associated with change detection. Results from animal studies (Malmierca et al., 2009; Kraus et al., 1994) suggest that cognitive evoked potentials recorded from the human scalp might be preceded by even earlier novelty-related activity.
The goal of the current study is to investigate the effect of auditory deviance detection using an oddball paradigm for speech syllables from the frequency following response (FFR), an auditory brainstem (ABR) response (Russo et al., 2004).

ABR were recorded from 18 participants at Cz using right earlobe as reference. Five stimuli were generated with the Klatt speech synthesizer. The syllables were composed of five formants and differed in duration of the first and second formant transition (25, 40, 55, 70, 85 ms). The stimuli were perceived either as /ba/ or as a soft to a strong /wa/ (wa1, wa2, wa3, wa4). Three blocked conditions were presented: an oddball block with a deviant /wa/1 probability of p=0.2; a reverse oddball block with a deviant /ba/; and a control block in which the five stimuli were presented randomly, each with a probability of p=0.2.

8192-points Fourier analyses were applied for the ABR averages and the normalized mean spectral amplitude was calculated for 10 Hz wide bins surrounding the F0 (100 Hz) and the subsequent three harmonics, H2, H3, H4 (Chandrasekaran et al., 2009) within the 20-85 ms time period. The spectral amplitudes of the H2 (F2,34=10.241, p=0.001, =0.833) and H4 (F2,34=4.266, p=0.026, =0.920) for the /ba/ syllable were significant smaller for the deviant stimulus than for the responses elicited both to the standard and to the control stimuli. No significant effects were found for the /wa/1 syllable.

The results of the present study have revealed that auditory deviance detection can take place in human auditory brainstem, supporting the notion that novelty detection is a basic property of the functional organization of the auditory system that acts at different levels along the auditory pathway.

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