Tinnitus and Multimodal Cortical Interaction.

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Abstract:

Background: Subjective tinnitus, characterized by the perception of noise without an external source, is often mistakenly viewed solely as an auditory issue. However, clinical observations reveal significant comorbidities associated with chronic tinnitus. Neurophysiological investigations using various imaging techniques depict a complex picture, indicating involvement not only of the auditory system but also of a widespread subcortical and cortical network. Disturbances are evident not only in auditory processing systems but also in networks comprising frontal and parietal regions. These findings underscore the necessity for a multidisciplinary and multimodal approach to the diagnosis and treatment of tinnitus.

Methods: Magnetic resonance imaging (MRI), renowned for its high spatial accuracy in detecting structural and functional brain properties, allows precise localization of structures and corresponding activation. Additionally, diffusion tensor imaging (DTI) methods, based on structural MRI, enable imaging and quantification of diffusion movements of water molecules in the brain. Electroencephalography (EEG) and magnetoencephalography (MEG) record synchronized activity of large cell clusters non-invasively. These methods enable the recording of both spontaneous and evoked brain activity.

Results: This review provides an overview of common non-invasive procedures aimed at capturing the structural and functional properties of the brain across a broad area. Initial studies suggest that cortical changes in tinnitus extend beyond auditory regions to include emotion-relevant areas.

Conclusion: Longitudinal studies, particularly those examining the transition from acute to chronic tinnitus, are essential for elucidating the causal role of specific brain areas and networks. Combining neurophysiological procedures would be advantageous for leveraging the strengths of different techniques, enabling insights into spatial and temporal aspects of brain activation.

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