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Functional neuroimaging of language and memory using magnetoencephalography (MEG)

Functional localization of eloquent cortices, covering or adjoining the pathological brain regions, is needed during many neurosurgical interventions. In particular, the hemispheric lateralization of language and memory functions as well as localization of cortical regions involved in language processing are often essential, especially in cases of epilepsy surgery. Currently, such localization is performed predominantly through invasive methods: The Wada test (intracarotid sodium amobarbital procedure) is most commonly used to assess the hemispheric dominance of language and memory during the pre-surgical evaluation of patients and, electrocortical stimulation is routinely used intra- or extra-operatively to localize cortical regions underlying receptive and expressive language processing. Although both of these procedures are well-established means for the functional evaluation of eloquent cortex, they have also some important limitations, such as risk of morbidity due to their invasive nature, variability in responses to barbiturate agents and arterial anatomy, limited spatial extent of electrocortical stimulation, which is confined to small area of craniotomy, etc. Magnetoencephalography (MEG) is the most novel, completely non-invasive functional neuroimaging technique capable of generating activation maps for the entire brain in real-time. The evidence from research suggests that MEG can be used effectively to assess the hemispheric dominance of language and memory, and to map the cortical regions supporting the linguistic functions of speech production (Broca's area) and comprehension (Wernicke's area), in individual patients. Non-invasive mapping of language-specific cortical zones, during routine pre-surgical evaluation of patients, can significantly facilitate surgical planning and reduce morbidity associated with resection of eloquent cortex. In this presentation, I will describe recently developed activation protocols and methodologies for identifying the hemispheric lateralization of language and memory, and mapping of the language-related eloquent cortex. I will highlight the potential of MEG in the pre-surgical evaluation, and will argue for widening the scope of MEG applications in clinical practice.

Biography

Vahe Poghosyan completed his MSc in Mathematics from Yerevan State University and PhD in Neurophysiology from National Academy of Sciences of Armenia. He held positions of Research Scientist in RIKEN Brain Science Institute in Japan, Senior Scientist and Director of Research Training Program at AAI Scientific Cultural Services Ltd. in Cyprus. Currently, he is the Head of MEG Laboratory and Consultant of Neuronavigation at King Fahad Medical City in Riyadh, KSA. He has published more than 20 research papers in high-impact journals in the field of Neuroscience.

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