Seizure focus

An epileptogenic focus, also known as a seizure focus, is a specific area within the brain where abnormal electrical activity initiates and generates epileptic seizures. Epileptic seizures are characterized by sudden, uncontrolled bursts of electrical activity in the brain, leading to a variety of symptoms and manifestations, including altered consciousness, convulsions, and unusual sensory experiences.

The epileptogenic focus is the region of the brain where this abnormal electrical activity begins. It can be a localized area, such as a small region within one cerebral hemisphere, or it may involve multiple brain regions. The exact location of the focus can vary from one person to another, as epilepsy is a heterogeneous condition.

Epileptogenic foci are often identified through a combination of diagnostic methods, including electroencephalography (EEG), brain imaging techniques such as magnetic resonance imaging (MRI), and clinical evaluation of a patient's symptoms and medical history. The goal of identifying the epileptogenic focus is to help determine the most appropriate treatment options, which may include medications, surgical interventions, or other therapeutic approaches to manage or control seizures.

Accurate localization of the epileptic focus is essential for surgical treatment of patients with drug resistant epilepsy. EEG source imaging (ESI) is increasingly used in presurgical evaluation. However, most previous studies analysed interictal discharges. Prospective studies comparing feasibility and accuracy of interictal (II) and ictal (IC) ESI are lacking.

Sharma et al., prospectively analysed long-term video EEG recordings (LTM) of patients admitted for presurgical evaluation. They performed ESI of II and IC signals, using two methods: equivalent current dipole (ECD) and distributed source model (DSM). LTM recordings employed the standard 25-electrode array (including inferior temporal electrodes). An age-matched template head-model was used for source analysis. Results were compared with intracranial recordings (ICR), conventional neuroimaging methods (MRI, PET, SPECT) and outcome one year after surgery.

Eighty-seven consecutive patients were analysed. ECD gave a significantly higher proportion of patients with localised focal abnormalities (94%) compared to MRI (70%), PET (66%) and SPECT (64%). Agreement between the ESI methods and ICR was moderate to substantial (k=0.56-0.79). Fifty-four patients were operated (47 for more than one year ago) and 62% of them became seizure-free. Localization accuracy of II-ESI was 51% for DSM and 57% for ECD; for IC-ESI this was 51% (DSM) and 62% (ECD). The differences between the ESI methods were not significant. Differences in localization accuracy between ESI and MRI (55%), PET (33%) and SPECT (40%) were not significant.

II and IC ESI of LTM-data have high feasibility and their localisation accuracy is similar to the conventional neuroimaging methods [1].

1)
Sharma P, Scherg M, Pinborg LH, Fabricius M, Rubboli G, Pedersen B, Leffers AM, Uldall P, Jespersen B, Brennum J, Mølby Henriksen O, Beniczky S. Ictal and interictal electric source imaging in presurgical evaluation: a prospective study. Eur J Neurol. 2018 May 11. doi: 10.1111/ene.13676. [Epub ahead of print] PubMed PMID: 29751364.