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EPILEPSY

# Electric source imaging—an inexpensive and reliable method to estimate the epileptic focus

EEG is routinely used in the diagnosis of epilepsy. A new study has shown that this technique can also be used to sensitively and reliably localize the source of seizures in patients with epilepsy and identify the region(s) of the brain to be targeted during surgical resection in these individuals.

In a noninvasive technique called electric source imaging (ESI), mathematical algorithms can be used to localize the source of a given scalp EEG pattern in real time. "Several small studies already showed that ESI is able to precisely localize the epileptic focus in light of a possible resective procedure," says Margitta Seeck, lead investigator of the study, published in *Brain*. "However, a prospective validation study on a larger patient group was missing."

152 patients with pharmacoresistant focal epilepsy were included in the study. Before surgical resection, patients had readings taken using standard EEG (involving 19–29 electrodes) and some using high-resolution EEG (using over 128 electrodes). To locate the source of the seizures, the electrical readings were projected onto either standard MRI-based head models or individual head models based on the patient's MRI scan. "If the patient was seizure-free after resection of the identified electrical source, the estimation was deemed correct," explains Seeck.

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ESI enabled estimation of the epileptic focus with up to 88% specificity and 84% sensitivity. ESI had a higher sensitivity and specificity in epileptic focus localization than either MRI or PET, provided that the researchers used a sufficient number of electrodes, combined with individual MRI-based head models.

"ESI based on 128–256 channel recordings and projected into the individual patient's brain had a specificity above 80%," summarizes Seeck. "That is very good for a single clinical tool, especially in brain imaging." She also points out that the cost of using EEG is eight to 10 times lower than the cost of using MRI or PET.

Seeck asserts that ESI has excellent spatial and temporal precision in locating the focus of electrical activity in the brain. This technique also enables the rapid movement of electrical currents across the brain to be traced in real time. "This aspect of ESI may be relevant for understanding the onset and propagation of seizure activity, which is one of our current research projects," says Seeck.

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