Frontal lobe epilepsy

After temporal lobe epilepsy, frontal lobe epilepsy is the next most common type of epilepsy featuring partial seizures. Frontal lobe epilepsy may run in families. In one rare genetic disorder (called autosomal dominant frontal lobe epilepsy or ADFLE), several individuals in a family typically have seizures during sleep. Frontal lobe seizures can be caused by abnormal brain tissue, for example from a dysplasia, abnormal blood vessel, old stroke or trauma, rarely tumors, scars from prior infections and several other causes. In about half of cases, no cause is determined.

Diagnosis

Especially in hidden lesions causing drug resistant epilepsy in the frontal lobe (FLE), the localization of the epileptic zone EZ can be a challenge.

Magnetoencephalography (MEG) can raise the chances for localization of the (EZ) in combination with electroencephalography (EEG). Sommer et al investigated the impact of MEG-guided epilepsy surgery with the aid of neuronavigation and intraoperative MR imaging (iopMRI) on seizure outcome of FLE patients.

Case series

2016

Twenty-eight patients (15 females, 13 males; mean age 31.0±11.1 years) underwent surgery in the Department of Neurosurgery, University Hospital Erlangen.

All patients underwent presurgical MEG monitoring (two-sensor Magnes II or whole head WH3600 MEG system; 4-D Neuroimaging, San Diego, CA, USA). Of those, six patients (group 1) with MRI-negative FLE were operated on before 2002 with intraoperative electrocorticography (ECoG) and invasive EEG mapping only. Eleven patients with MRI-negative FLE (group 2) and eleven with lesional FLE (group 3) underwent surgery using 1.5T-iopMRI and neuronavigation, including intraoperative visualization of the MEG localizations in 22 and functional MR imaging (for motor and speech areas) as well as DTI fiber tracking (for language and pyramidal tracts) in 13 patients.

In the first group, complete resection of the defined EZ including the MEG localization according to the latest postoperative MRI was achieved in four out of six patients. Groups two and three had complete removal of the MEG localizations in 20/22 (91%, 10 of 11 each). Intraoperative MRI revealed incomplete resection of the MEG localizations of four patients (12%; two in both groups), leading to successful re-resection. Transient and permanent neurological deficits alike occurred in 7.1%, surgery-associated complications in 11% of all patients. In the first group, excellent seizure outcome (Engel Class IA) was achieved in three (50%), in the second in 7 patients (61%) and third group in 8 patients (64%, two iopMRI-based re-resections). Mean follow-up was 70.3 months (from 12 to 284 months).

In these series, MEG-guided resection using neuronavigation and iopMR imaging led to promising seizure control rates. Even in non-lesional FLE, seizure control rates and the probability of complete resection of the MEG localizations was similar to lesional FLE using multimodal navigation [1)].

Case report

2016

A girl with progressive left frontal tissue destruction starting at the age of almost 8 years. She manifested acutely with epileptic seizures accompanied by Broca aphasia as well as transient right hemiparesis. Due to refractory epilepsy developing over the next years, which originated from the left frontal lobe, the decision was made to proceed to epilepsy surgery. By then, her language functions had recovered despite progressive left frontal tissue-destruction, raising the possibility of a hemispheric shift of language. Clinical functional magnetic resonance imaging (fMRI) was conducted to localize brain regions involved in language production. A complex pattern of clear right-hemispheric dominance, but with some left-sided contribution was found. However, a Wada test suggested the left hemisphere to be critical, seemingly contradicting fMRI. Invasive electroencephalogram recordings could reconcile these results by identifying the fMRI-detected, residual left-sided activation as being relevant for speech production. Only by combining the localizing information from fMRI with the information obtained by two invasive procedures could the unusual pattern of late-onset language reorganization be uncovered. This allowed for extensive left frontal resection, with histology confirming meningocerebral angiodysplasia. Postoperatively, language functions were preserved and seizure outcome was excellent. The implications of the findings for presurgical assessments in children are discussed [2].

1)
Sommer B, Roessler K, Rampp S, Hamer HM, Blumcke I, Stefan H, Buchfelder M. Magnetoencephalography-guided surgery in frontal lobe epilepsy using neuronavigation and intraoperative MR imaging. Epilepsy Res. 2016 Jun 25;126:26-36. doi: 10.1016/j.eplepsyres.2016.06.002. [Epub ahead of print] PubMed PMID: 27423016.
2)
Lorenzen A, Wilke M, Alber M, Milian M, Bornemann A, Ernemann U, Rona S. Multimodal Assessment Reveals Late-Onset Hemispheric Shift of Language in a Child with Meningocerebral Dysplasia. Neuropediatrics. 2016 Jul 27. [Epub ahead of print] PubMed PMID: 27462834.