ABSTRACT

The presented dissertation deals with prognostic factors influencing a favorable postoperative outcome in patients undergoing surgical treatment of epilepsy and the possibilities of improving the methods used in the localization of epileptogenic lesions. This work is based on the results of four published studies.

The first study evaluated the factors influencing the long-term outcomes of epilepsy surgery in MRI-negative (nonlesional) extratemporal lobe epilepsy (nETLE). The aim of the study was to evaluate the benefit of non-invasive diagnostic tests and their relationship with a favorable surgical outcome in a group nETLE patients. Univariate analysis showed that localized interictal epileptiform discharges (IEDs) on the scalp EEG were associated with a favorable surgical outcome. Diagnostic difficulty in this group of patients is highlighted by the fact that, although 9 of 24 patients undergoing surgery had a favorable outcome, and only nine of 85 patients with nETLE achieved such a favorable outcome.

The second work evaluated the benefit of SPECT (Single Photon Emission Tomography) statistical processing over traditional subtraction methods in patients with MRI-negative temporal lobe epilepsy (nTLE) and MRI-negative extratemporal epilepsy (nETLE). 49 consecutive patients who underwent interictal and ictal SPECT before resection were identified. Interictal and ictal SPECT scans were analyzed using SISCOM (Subtraction Ictal-Interictal SPECT Coregistered with MRI) and using SPM. Blinded reviewers were asked to identify the location where the seizures were most likely to originate from. In both nTLE and nETLE patients, hyperperfusion foci detectable by SPM methods were more frequently localized to the site of resection compared to the SISCOM method. In the group of patients with MRI-negative epilepsy, SPM methods showed a better localization value of SPECT hyperperfusion to the surgical site and a higher agreement between reviewers than the SISCOM method. These results show the benefit of SPECT statistical processing.

The third study looked at the importance of scalp EEG and intraoperative electrocorticography (ECoG) in the examination of patients with nTLE undergoing standard anterior temporal lobectomy with amygdalohippocampectomy (ATL), the importance of detecting interictal epileptiform discharges (IED) and its connection to a favorable surgical outcome. Our work showed that unilateral IEDs on scalp and complete resection of IED-generating tissue in baseline, non-opiod induced intraoperative ECoG were associated with favorable outcomes.

The last study dealt with the possibilities of using intravascular EEG electrodes. To determine the utility of intravascular approaches to obtain broadband intracranial EEG recording, an intravascular catheter with macro- and micro-electrodes was inserted into the superior sagittal sinus of anesthetized pigs together with standard clinical subdural electrodes to record epileptiform activity induced by direct cortical penicillin injection. and to record responses to electrical stimulation. Intravascular macro- and micro-electrodes recorded IEDs of similar size and shape, suggesting that intravascular

electrodes may provide location information about seizure location. Electrical stimulation shown that intravascular electrodes provided sufficient fidelity to record high-frequency physiological (non-epileptiform) events.

The results of these studies demonstrate that patients with MRI-negative temporal and extratemporal epilepsy represent a major diagnostic and therapeutic challenge for epilepsy surgery. Studies aimed to improve current diagnostic methods to localize epileptogenic focus. Combination of these modalities can help to ensure safe and successful surgery and to make it more accessible to patients who until now lacked localization hypothesis to plan an epilepsy surgery. The last part of our work describes use of innovative methods in accessing brain regions by means of vascular system, areas that are currently being explored by more conventional transcranial approaches.

Key words: epilepsy, epilepsy surgery, SPECT, PET, MRI-negative epilepsy, iEEG, ECoG