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Predictors and outcome surgery for posterior cortex epilepsies

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ABSTRACT

Objective: The aim of this study is to identify the prognostic role of MRI and EEG in posterior cortex epilepsies (PCES) and to characterize their clinical features.
Patient and Methods: We retrospectively studied 54 consecutive patients (18 females, 36 males) from April 2011 to November 2015, who had undergone PCES surgery. Electro-clinical, pathological and surgical data were evaluated. Of the patients, 18 (33.3%) patients underwent a cortical resection (corticectomy), 10 (18.5%) lobectomy, 6 (11.1%) multilobar resection, 20 (30.1%) disconnection.
Results: The postoperative follow-up duration was ≥1 year in all patients (12–44 months, mean = 25). Thirty-two patients (59.3%) became seizure free (ILAE 1) and 40 (74.1%) had a good (ILAE 1, 2, 3) outcome. The most common pathological finding was focal cortical dysplasia (in 34 patients). Univariate analysis showed that regional scalp interictal epilepsy discharges (IEDs) (P = 0.031), Regional EEG onset (P = 0.027), a MRI lesion (P = 0.001) and the number of seizures that were recorded by the epilepsy monitor unit (P = 0.016) were significantly associated with freedom from seizures. Multivariate analysis confirmed that MRI positive was statistically significant (HR = 4.284, CI = 1.198–15.315).
Conclusions: Surgical treatment is effective for PCES, and MRI and EEG analyses are important in presurgical evaluation of PCES.

1. Introduction

Posterior cortex epilepsies (PCES) are a group of epilepsies that originate from the parietal, occipital, or occipital border of the temporal lobe or from any combination of these areas. Surgery for PCES represents < 10% of all epilepsy surgeries [1,2]. Grouping these epilepsies together as PCES would probably allow better analysis and understanding of the disease [3–6]. Clinical diagnosis is difficult because of nonspecific patterns in the seizures as well as fast ictal spread to distant brain areas [4,6–8]. The interictal and ictal epilepsy discharges are unreliable markers of the posterior cortex origin of seizure activity [9]. Compared with the results of surgical treatment for temporal lobe epilepsy, success rates for the PCES surgery have been less promising. In this study, we retrospectively reviewed a cohort of patients who underwent epilepsy surgery for PCES. We analyzed demographic, electro-clinical, and seizure semiology to determine outcome and predictors of outcome.

2. Patient and methods

We retrospectively studied 54 consecutive patients (18 females, 36 males) with medically refractory epilepsy who had undergone PCES surgery from April 2011 to November 2015. We defined PCES as epilepsy where the EEG onset zone, as determined by EEG onset and/or successful resection, originated from the parietal, occipital, or occipital border of the temporal lobe, or from any combination of these areas.

2.1. Preoperative patient evaluation

All patients underwent brain magnetic resource image (MRI). Standard MRI was performed on a Siemens 3.0 T SP system (Siemens, Erlangen, Germany) using a standardized epilepsy protocol that included high-resolution T1-weighted volume acquisition, T2-weighted, and fluid attenuated inversion recovery (FLAIR) sequences. The MRI lesion was classified into one of the following subgroups: parietal, occipital, parietooccipital, temporooccipital, and temporo-parieto-occipital regions. The MRI was classified as negative if no epilepsy-

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Table 1
Clinical data.

	Overall group	Seizure-free	Non-seizure-free	*p*-value
Clinical characteristics				
Gender F/M	20/34	12/20	8/14	1.00
Hemisphere L/R	22/32	14/18	8/14	1.00
Age at onset, years	8.44 ± 7.60	8.63 ± 8.32	8.18 ± 6.82	0.885
Age at surgery, years	22.37 ± 10.87	22.38 ± 12.82	22.36 ± 7.79	0.998
Epilepsy duration, years	14.00 ± 7.71	13.88 ± 8.06	14.18 ± 7.56	0.921
Number of seizures	6.59 ± 7.47	8.76 ± 9.12	4.00 ± 2.79	0.016
Seizure semiology: yes/no				
aura	20/34	8/24	12/10	0.224
Lateralized ictal semiology	34/20	20/12	14/8	0.932
sGTCS	32/22	20/12	12/10	0.559
Presurgical evaluation yes/no				
Regional IED	36/18	25/7	11/11	0.031
Regional EEG onset	34/20	24/8	10/12	0.027
Leision location				
One lobar/multi lobar	30/24	18/14	12/10	0.901
MRI scan				
Positive/negative	38/16	28/4	10/12	0.001
PET scan				
Positive/negative	16/6	10/2	6/4	0.348
Invasive EEG				
Yes/ No	16/38	8/24	8/14	0.327
SDE/SEEG	10/6	6/3	4/3	1.000
Type of surgery				
corticectomy	18	13	5	0.536
lobectomy	10	6	4	
multilobar resection	6	3	3	
disconnection	20	10	10	
Pathology				
FCD I/FCD II	12/18	8/12	4/6	1.000
FCD/ others	34/20	22/10	12/10	0.391

Legend: F = female; M = male; L = left; R = right; sGTCS = secondary generalized tonic-clonic seizures; IED = interictal epileptic discharges; EEG = electroencephalography; MRI = Magnetic Resource Imaging; PET = positron emission tomography; SDG = subdural grids; SEEG = stereo-electroencephalography; FCD = Focal Cortex Dysplasia.

attributable focal lesions were seen. Some patients also had a fluorodeoxyglucose (FDG)–positron emission tomography (PET) scan and/or magnetoencephalography (MEG) scan if there were no clear epileptogenic lesion on MRI.

Video-EEG duration ranged from 1 to 37 days (mean = 9 days). Interictal/ictal scalp electroencephalography (EEG) was recorded using a video-EEG monitoring system with electrodes placed according to the international 10–20 system. Interictal spikes were reviewed; their frequency, ratio, and localization were visually assessed; interictal and ictal EEG were classified as focal, posterior quadrant, and diffuse [4]. Regional interictal epilepsy discharges (IEDs) were defined as focal and posterior quadrant IEDs. Intracranial EEG was performed in 16 patients, and intracranial EEG was implanted for any of the following reasons: (a) to confirm the ictal onset zone if scalp EEG information was either nonlocalizing or inconsistent with other noninvasive investigations such as MRI or seizure semiology; (b) to perform functional mapping preoperatively if the ictal onset zone was thought to be close to eloquent cortex; and (c) to identify a suspected multifocal epileptogenic process based on multifocal noninvasive EEG findings or multilobar involvement on imaging.

In total, 388 seizures were recorded (mean = 7 seizures per patient; range, 1–44 seizures). Interictal discharges and ictal patterns were analyzed by lobar distribution, relationship to the side of surgery (ipsilateral or contralateral), and their extent (regional, lateralized, or generalized). All auras and seizures in the pre-surgical video-EEG monitoring phase were recorded for statistical analysis. The following ictal semiology was considered lateralized or localized: contralateral somatosensory and visual auras; contralateral tonic, clonic seizures; contralateral nystagmoid eye deviation or versive seizures [4,10,11].

2.2. Surgery and surgical outcome

Surgeries were classified by location (parietal, occipital, or parieto-occipital) and by type (lesionectomy, lobectomy, multilobar resection or disconnection). The surgery types were determined by individual imaging and electrophysiological studies. We modified the disconnection procedure for each patient based on the location of the EEG onset zone. Patients were additionally classified into 2 subgroups: seizure free (ILAE class I) and not seizure free (ILAE classes II, III and IV). Postoperative clinical information was obtained from patient visit notes and follow-up phone calls. The typical follow-up schedule consisted of a clinic visit at 3 postoperative months, 6 months, 1 year, and then yearly.

2.3. Outcome

Epilepsy surgery outcome, assessed at the last follow-up visit, was classified using the International League Against Epilepsy (ILAE) scoring system [12]. In our study, only ILAE class I was classified as freedom from seizures and ILAE class I-III were considered as good outcome. Statistical analysis was performed using SPSS statistics 22 (IBM). Pearson *X* was used to analyze sex, seizure semiology, irritative zone, EEG onset zone, and lateralization and localization of surgery. We used an analysis of variance (ANOVA) for age at surgery, age at seizure onset, duration of epilepsy, and number of seizures. Statistical significance was defined as $P < 0.05$. An additional multivariate Cox proportional hazard regression model was used. Results were considered statistically significant at the 5% level. Statistical significance was tested using the log-rank test and comparison of 95% confidence intervals (CIs).