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Surgical treatment for patients with symptomatic generalised seizures due to brain lesions

Tao Yu[a,*], Guojun Zhang[a], Yuping Wang[b], Duanyu Ni[a], Liang Qiao[a], Wei Du[a], Yuanyuan Piao[a], Yongjie Li[a]

[a] Beijing Institute of Functional Neurosurgery, Xuanwu Hospital, Capital Medical University, China
[b] Comprehensive Epilepsy Center of Beijing, Xuanwu Hospital, Capital Medical University, China

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Summary
Object: To study the role of epilepsy surgery for patients with focal lesions who exhibited the semiology of clinically generalised seizures.
Methods: From our epilepsy surgery series, we identified 29 patients who underwent surgery for seizures, including certain types of generalised seizures, according to their ictal semiology. We systematically reviewed the brain imaging, video-EEG, surgical operation, and pathological findings data of these patients.
Results: All patients had at least one type of generalised seizure according to the semiology; these seizures included epileptic spasms, myoclonic seizures, tonic seizures, atonic seizures and atypical absence seizures. Eight patients had a single type of seizure, 11 patients had two types of seizures, and 10 patients had more than two types of seizures. In addition to symptomatic generalised seizures, complex partial seizures were also recorded in eight patients. In 24 patients, the ictal semiology showed slight asymmetric movements in certain types of seizures. Generalised interictal epileptic discharges were recorded in 24 patients; and generalised ictal epileptic discharges as the only EEG pattern were recorded in 13 patients. Intracranial recording was performed in 20 patients; 10 of whom showed a rhythm of fast activities at the initiation of the seizures. Functional hemispherectomy was performed for three patients with hemispheric lesions. Focal resection of the epileptogenic zone was performed in 26 patients. The resected epileptogenic zones involved a single lobe in 10 patients, two lobes in 11 patients, and three lobes in 5 patients; the parietal lobe was the most commonly involved lobe (in 19 cases).

* Corresponding author at: Beijing Institute of Functional Neurosurgery, Xuanwu Hospital, Capital Medical University, No. 45 Changchun Street, Beijing 100053, China. Tel.: +86 10 83163174; fax: +86 10 83163174.
E-mail address: yutaoly@sina.com (T. Yu).

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Scar lesions (in 17 patients) were most commonly observed on pathological examination. At the last follow-up (mean 18 ± 8.3 months, range 12—48), 17 (58.6%) patients were seizure-free.
Conclusions: Certain patients with local brain lesions can have seizures with specific types of generalised semiology. An appropriate operation may be helpful for a portion of these patients.

The terms ''focal'' and ''generalised'' have been used to express a dichotomous classification for both seizures and epilepsy. However, it has been previously noted that focal cortical abnormalities can cause seizures with generalised clinical semiology and, occasionally, EEG findings. For example, absences, epileptic spasms, myoclonic seizures, and even atonic seizures have been reported secondary to focal brain lesions in certain patients (Farwell and Stuntz, 1984; Millan et al., 2001; Chugani et al., 1992; Akiyama et al., 2005; Ramachandrannair et al., 2008; Zhao et al., 2010; Kovac and Diehl, 2012). In this article, we use the term ''symptomatic generalised seizure'' to describe a seizure that has generalised ictal semiology due to a local brain lesion.

From January 2008 to June 2013, we used MRI to image patients with focal lesions; the patients showed ictal semiology of certain types of clinical generalised seizures. We localised the epileptogenic zones and performed respective surgeries in these patients. The goal of this study was to present the outcomes of surgical treatment for these patients and to analyse the relationship between the focal lesions and seizures with generalised semiology.

Patients and methods

Patients

Patients were selected from a pool of children and adults who underwent presurgical evaluation and surgical treatment for the relief of intractable epilepsy; the study was performed at the Comprehensive Epilepsy Centre of Beijing between January 2008 and June 2013. Among the total 1298 patients who received surgical treatment, 32 patients had local lesions on MRI-associated generalised seizures. The seizure type was classified according to the reports of the ILAE on the classification of seizures and epilepsies (Wieser et al., 2001; Engel, 2006; Berg et al., 2010). Despite the controversy, in this article, spasms were classified as generalised seizures. Patients were selected according to the following criteria: (1) patients with refractory epilepsy; (2) patients with severe seizures, including daily seizures with loss of consciousness, falls, or frequent status epilepticus; (3) patients with one or more types of generalised seizures were recorded by the video-EEG, with or without a partial seizure; (4) brain lesions on the MRI, including multiple lesions or hemispheric lesions; and (5) no contraindication to performing the surgical resection.

The final sample consisted of 32 (2.4%) patients who underwent surgical resection. Three patients failed the postoperative follow-up. The seizure histories, imaging and video-EEG monitoring data, operative records and pathological findings of the remaining29 patients were analysed. Sixteen patients (55.2%) were male, and 13 (44.8%) were female. Patient age at the time of surgery ranged from 3 to 34 years (mean age: 10.8 ± 8.0 years). The average seizure onset age was 3.1 ± 2.6 years (range 0.5—10 years).

Presurgical evaluation

MR imaging

Each patient underwent a standard MRI protocol that was performed using a 1.5-T or 3.0-T MR scanner (Siemens, Munich/Erlangen/Verio, Germany) and consisted of conventional spin-echo T1-weighted axial, sagittal, coronal and T2-weighted axial sequences (section thickness: 5 mm, image gaps: 1 mm). Additionally, 5-mm-thick Fluid Attenuated Inversion Recovery images were obtained; these images included axial and coronal sections that were perpendicular to the long axis of the hippocampus.

Video-EEG monitoring and seizure semiology

Interictal/ictal scalp EEGs were recorded using a video-EEG monitoring system (Micromed; Treviso, Italy); the electrodes were arranged according to the international 10—20 system. The duration of video-EEG monitoring ranged from 2 to 7 days, and at least three habitual seizures were recorded for each patient. We attempted to record every type of seizure if the patient had more than one type of seizure. The seizure type was classified by two epileptologists, according to the video-EEG findings (without the MRI information of the patient). If the patient was identified as having a certain type of generalised seizures, we further analysed the clinical semiology and interictal/ictal EEG, and we attempted to identify trends of asymmetry as a clue to the lateralisation of epileptogenic zones.

Intracranial EEG monitoring and functional mapping

Intracranial EEG monitoring was performed to further localise the epileptogenic zone; exceptions were for patients with a hemispheric lesion that was suitable for hemispherectomy or patients with a focal lesion distant to an eloquent area of the brain. The placement of the grid and strip electrodes was guided by non-invasive exams and intraoperative electrocorticography. The EEG sampling rate was set at 1024 Hz to record more details of seizure propagation. Usually, more than two habitual seizures were required to be recorded; we tried to record every type of seizure for each patient during the long-term intracranial EEG monitoring. Preoperative direct cortical stimulation for functional mapping was performed in patients with epileptogenic zones near the eloquent cortex, such as the motor, sensory or language areas.