Epilepsy & Behavior 64 (2016) 57–61

Contents lists available at ScienceDirect

Epilepsy & Behavior

journal homepage: www.elsevier.com/locate/yebeh

Temporal lobe origin is common in patients who have undergone epilepsy surgery for hypermotor seizures

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ARTICLE INFO

Article history:
Received 2 June 2016
Revised 6 September 2016
Accepted 8 September 2016
Available online 11 October 2016

Keywords:
Epilepsy
Seizures
Hypermotor seizures
Complex partial seizures
Epilepsy surgery
Temporal lobectomy
Frontal lobe epilepsy

ABSTRACT

Rationale: Hypermotor seizures are most often reported from the frontal lobe but may also have temporal, parietal, or insular origin. We noted a higher proportion of patients with temporal lobe epilepsy in our surgical cohort who had hypermotor seizures. We evaluated the anatomic localization and surgical outcome in patient with refractory hypermotor seizures who had epilepsy surgery in our center.
Methods: We identified twenty three patients with refractory hypermotor seizures from our epilepsy surgery database. We analyzed demographics, presurgical evaluation including semiology, MRI, PET scan, interictal/ictal scalp video-EEG, intracranial recording, and surgical outcomes. We evaluated preoperative variables as predictors of outcome.
Results: Most patients (65%) had normal brain MRI. Intracranial EEG was required in 20 patients (86.9%). Based on the presurgical evaluation, the resection was anterior temporal in fourteen patients, orbitofrontal in four patients, cingulate in four patients, and temporoparietal in one patient. The median duration of follow-up after surgery was 76.4 months. Fourteen patients (60%) had been seizure free at the last follow up while 3 patients had rare disabling seizures.
Conclusions: Hypermotor seizures often originated from the temporal lobe in this series of patients who had epilepsy surgery. This large proportion of temporal lobe epilepsy may be the result of a selection bias, due to easier localization and expected better outcome in temporal lobe epilepsy. With extensive presurgical evaluation, including intracranial EEG when needed, seizure freedom can be expected in the majority of patients.

1. Introduction

Hypermotor seizures are characterized by complex stereotypical movements involving the proximal limb and trunk resulting in large inappropriate movements such as kicking, pedaling, pelvic thrusting, or body rocking, often accompanied by loud vocalization [1–3]. Hypermotor seizure semiology is usually associated with frontal lobe origin. However, hypermotor seizures have also been described from extrafrontal regions, mainly temporal lobe and insular areas [4–7]. Data about localization and surgical outcome in medically refractory hypermotor seizures are limited. We studied our patients with hypermotor seizures who underwent epilepsy surgery.

2. Methods

This retrospective study was approved by the Vanderbilt institutional review board. We reviewed our database of epilepsy surgery of 521 patients operated on for refractory partial epilepsy at our institution between March 1998 and December 2013, and identified 23 patients (4.4%) who had hypermotor seizures. Five of these patients had been described in earlier publications [6,8]. Hypermotor seizures were defined by ictal complex motor agitation with proximal movements of the limbs, trunk, and pelvis. We analyzed seizure history, presurgical evaluation results, including interictal/ictal scalp EEG and video semiology, MRI, FDG-PET scan, intracranial recording, localization of the epileptogenic zone, surgical resection, pathology, and surgical outcome. Median follow-up after epilepsy surgery was 42 months (lower quartile–upper quartile range 27–133 months). We evaluated preoperative variables as predictors of outcome. Imaging results including PET hypometabolism were based on consensus visual inspection of epileptologists attending the epilepsy surgery conference.

2.1. Intracranial EEG

Intracranial electrode placement (20 patients) was guided by noninvasive presurgical examinations, corresponding to the ictal EEG and PET scan abnormalities. Dorsolateral frontal and lateral temporal cortex were covered by grid electrodes in all patients where intracranial

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http://dx.doi.org/10.1016/j.yebeh.2016.09.019
1525-5050/

electrodes were used (19 patients). Interhemispheric electrodes were placed in 8 patients. Eight patients had grids plus strips. Two patients had stereoelectroencephalography (SEEG), one of these patients had bitemporal depth electrodes in addition to grids. The intracranial electrodes had to be secured carefully so they would not move or get dislodged during the hypermotor seizures. At least three typical seizures were recorded in each patient during the intracranial EEG monitoring.

2.2. Statistical methods

Demographic and clinical variables were summarized. Descriptive summaries of continuous variables were presented in terms of median and interquartile range (IQR) while discrete variables were summarized in terms of frequencies and percentage. Engel classification groups 1 and 2 were compared with groups 3 and 4 for demographic and clinical variables. Wilcoxon rank sum test or Fisher's exact test were used for statistical comparisons. Because of the limited sample size, no further adjusted analysis was done. Statistical software R version 2.13.2 (2011-09-30) (www.r-project.org) was used for all data analysis. Reported p values were two-sided and a p value of less than 0.05 was considered to indicate statistical significance.

3. Results

3.1. Patients

We identified 23 patients with refractory hypermotor seizures that underwent resective surgery. There were 11 men and 12 women. The median age at seizure onset was 9 years and the median age at surgery was 30 years. Eight patients (34.7%) had predominantly nocturnal seizures (Table 1).

3.2. Etiological factors

Two patients had history of febrile seizures in childhood, two patients had head injury, and two patients had meningitis. Six patients had temporal lobe lesions: two patients had left temporal pole cortical dysplasia, one had a right temporal pole cavernous malformation, one patient had right temporal radiation injury as a result of prior radiation for pituitary adenoma, one patient had right mesial temporal sclerosis, and one patient had a right sphenoidal mass lesion compressing the mesial temporal lobe. One patient had a right small orbitofrontal pilocytic astrocytoma, and one patient had multiple white matter increased signal lesions. The remaining patients had no known etiology.

3.3. Seizure semiology

Eight patients reported an aura with their seizures: three patients described a scary feeling, three patients mentioned a feeling of falling or blacking out, one patient described butterflies in the stomach, and another patient described a deja vu experience.

The clinical seizures included screaming, moaning, thrashing, fearful expression, complex and repetitive hyperkinetic arm and leg automatisms, and side-to-side turning of the torso at high speed. Video analysis of seizure semiology showed predominant expression of fear in 19 patients, hyperkinetic arm and leg movements in all patients, loud screaming in 14 patients, and other vocalization in 14 patients. Dystonic posturing was seen in 5 patients.

There was no significant difference between temporal (15) and frontal lobe (8) seizures in semiology or nocturnal predilection.

3.4. EEG localization (scalp and intracranial)

In fifteen patients the scalp EEG showed ictal onset in the temporal region, while four had bilateral frontocentral ictal onset, two patients

Table 1
Demographics.

Variables		Number (percentage)
Male gender		11 (47.83%)
Predominantly nocturnal seizures		8 (34.7%)
Number of AEDs at surgery:	1	7 (30%)
	2	11 (47.8%)
	3	3 (13.0%)
	4	2 (8.7%)
Ictal onset lateralization: right		15 (65.2%)
Left		5 (21.7%)
Indeterminate		3 (13%)
Intracranial monitoring done: yes		20 (86.9%)
MRI normal		15 (65%)
Surgical resection site:	Anterior temporal/selective amygdalohippocampectomy	14 (60.8%)
	Cingulate	4 (17%)
	Orbitofrontal	4 (17%)
	Temporoparietal	1 (4.3%)
Histology of resected tissue:	Gliosis	11 (47.8%)
	Focal cortical dysplasia	4 (17%)
	Hippocampal sclerosis	4 (17%)
	Cavernous malformation	1 (4.3%)
	Hamartoma and pilocytic astrocytoma	2 (8.6%)
	Normal	1 (4.3%)
Seizure outcome Engel classification:	I	14 (60.8%)
	II	3 (13%)
	III	3 (13%)
	IV	3 (13%)
Continuous variables	Median (lower quartile–upper quartile)	
Epilepsy onset age in years	9 (4–19)	
Seizure frequency per month	16 (6–60)	
Age at surgery in years	30 (23–42)	
Follow-up duration postop in months	42 (27–133)	
Number of seizures recorded in EMU	10 (6–13)	