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Prognostic significance of postoperative spikes varied in different surgical procedures for mesial temporal sclerosis

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ABSTRACT

Purpose: We conducted this study to compare the occurrence and prognostic significance of early postoperative interictal epileptiform discharges (IEDs) on seizure outcomes between corticoamygdalohippocampectomy (CAH) and selective amygdalohippocampectomy (SAH).
Methods: We reviewed our database of patients who had epilepsy surgery with hippocampus atrophy or signal changes on brain MRIs and pathology of mesial temporal sclerosis. One hundred and seventy-seven CAH and 39 SAH patients were enrolled. Postoperative EEG within 30 days, other preoperative variables and seizure outcome 2 years after surgery were obtained for analysis. Engel's IA and IB were defined as seizure-free.
Results: There was no significant difference in the seizure-free rate between the two procedures (127 (71.8%) of CAH vs 30 (76.9%) of SAH, $p = 0.51$). Postoperative IEDs were more frequently seen in the SAH group (64.1%) than in the CAH group (29.9%), $p < 0.001$. The IEDs in the SAH group did not show correlation with the seizure outcome 2 years after surgery. In the CAH group, patients who had no postoperative IEDs showed a higher seizure-free rate compared to those with IEDs (78.2% vs 56.6%, $p = 0.003$; OR 2.267, 95% CI 1.09-4.73, $p = 0.029$ in multivariate logistic regression).
Conclusions: Early postoperative IEDs are more frequently seen in SAH than in CAH. Unlike in patients with CAH, the presence of IEDs after SAH was not a predictor of seizure recurrence. The type of surgery should be considered while utilizing postoperative IEDs for evaluating the prognosis.

1. Introduction

Drug resistant temporal lobe epilepsy can have a negative impact on people with epilepsy, including low quality of life, neurocognitive decline and increased risk of sudden unexpected death [1]. Cases that can be remediated by surgery could benefit more from surgery than remaining medical treatment [2]. Corticoamygdalohippocampectomy (CAH) is an effective treatment for patients with medically intractable medial temporal lobe lobectomy (MTLE) [2–4]. However, one third of CAH patients suffer from postoperative memory decline and a visual field defect is inevitable [5,6]. Selective amygdalohippocampectomy (SAH) was then developed to preserve the temporal neocortex with the possibility of less postoperative memory impairment and fewer visual field defects [7]. It could achieve comparable seizure freedom to CAH [8,9]. The reasons why a smaller resection could also produce seizure freedom are not well understood.

Interictal epileptiform discharges are usually regarded as a marker of a propensity to seizures. Postoperative spikes in CAH have been shown to be a significant prognostic factor for seizure recurrence [10–15]. Some reports showed that the postoperative spikes were frequently seen in SAH and had no significant relationship with postoperative seizure outcomes [16,17]. The different occurrence of spikes between these two procedures has seldom been investigated. We conducted this study to see if the occurrence of early postoperative spikes and its prognostic value after SAH are the same as those after CAH. Therefore, we can improve the assessment of postoperative seizure outcome by means of useful predictors.

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2. Materials and methods

2.1. Patients

Patient records from a database of 424 adult patients who had undergone epilepsy surgery for MTLE at Taipei Veterans General Hospital between August 1987 and June 2017 were reviewed. Patients who had tumors, cortical dysplasia or vascular lesions in the temporal lobes were excluded. In this study, we only enrolled patients with the following characteristics: (1) hippocampus atrophy or signal changes on brain MRI (2) pathological diagnoses that showed gliosis or typical mesial temporal sclerosis (MTS) (3) postoperative electroencephalography (EEG) within 30 days after surgery, and (4) postoperative follow-up for at least 2 years. This study was approved by the institutional review board of Taipei Veterans General Hospital.

2.2. Pre-surgical evaluation and the pre-surgical variables for analysis

Our pre-surgical evaluation included the following: long-term video-electroencephalography telemetry (video-EEG), brain magnetic resonance imaging (MRI), magnetic resonance spectroscopy, interictal and postictal single-photon emission computed tomography, fluoro-D-glucose positron emission tomography, psychiatric consultation, neuropsychological evaluation and Wada testing.

The study results were discussed at a multidisciplinary seizure conference and the side and type of surgery were determined for each case. Age at seizure onset, duration of epilepsy, age at surgery, history of febrile seizure, frequency of preoperative secondary GTCS and preoperative full-scale IQ were obtained from the chart review. According to the video-EEG recordings, IEDs were categorized as unifocal or non-unifocal. The interictal EEG was sampled for a two-minute duration every 30 min during the video-EEG recording. Frequent GTCS in this study was arbitrarily defined as more than two GTCS per month averaged over the three years prior to surgery.

2.3. Surgical procedures and postoperative follow-up

We only performed CAH for patients with MTLE with hippocampal atrophy on brain MRI for a time span of 23 years. The extent of resection of the lateral temporal neocortex varied from 4.5 cm (dominant hemisphere) to 5.5 cm (nondominant hemisphere), as measured from the temporal tip along the middle temporal gyrus. Amygdalohippocampectomy was later performed under the microscope. Selective amygdalohippocampectomy using the transylvian approach [7] was started in our surgical program in May 2010. Patients in this study also had an early postoperative routine scalp EEG recording within 30 days after surgery. IEDs were defined as the presence of spikes or sharps. The EEG recording was described in a previous study [10].

Patients were asked to follow-up regularly at our epilepsy clinic. For the few patients who preferred to be followed-up by their referring doctors, seizure outcomes were confirmed by telephone interviews every 3 months after surgery. Most of the patients were asked to continue their AEDs for at least 2 years and discontinue AEDs gradually after 2 years of seizure freedom. From our database, patients who had AED tapering or withdrawal within 2 years after surgery were noted to be 25 (11.6%). We arbitrarily categorized patients as seizure-free (Engel's IA and IB) and non-seizure-free (IC-IVB) [18].

2.4. Statistical analysis

Mann-Whitney t test, x^2 and Fishers' exact tests were used where appropriate for statistical analysis. Potential variables for seizure-free and non-seizure-free categories were analyzed by using aforementioned analysis and Cox proportional hazards models.

For the multivariate logistic regression and Cox proportional hazards regression, variables with significance at the 0.1 level in preliminary univariate analyses were submitted to the multivariate regression models with the backward stepwise method. A p value less than 0.05 was considered to be significant in this study.

3. Results

There were 269 patients who had undergone CAH or SAH for MTLE with hippocampal sclerosis. Among these patients, 216 had hippocampal atrophy on brain MRI, complete preoperative data, early postoperative EEG and at least 2 years of follow-up after surgery. One hundred and seventy-seven patients had CAH and 39 had SAH. The clinical characteristics are shown in Table 1. There was no significant difference in the seizure-related characteristics between the two different surgery groups. However, the age of surgery in the SAH group was significantly older than that of CAH

Table 1
Demographic and seizure characteristics of patients with corticoamygdalohippocampectomy and selective amygdalohippocampectomy.

		CAH (n = 177)			SAH (n = 39)		
Characteristics	N (%)	Mean	Range	N (%)	Mean	Range	p
Gender							
Male	79 (44.6%)			18(46.2%)			NS
Side of surgery							
Left	95 (53.7%)			16(41.0%)			NS
Age at epilepsy onset		12.2	0.1–45		14.8	0.9–38	NS
Age at surgery		30.5	18–57		34.8	12–58	$p = 0.024$
Duration of epilepsy		18.3	0.5–42		20.0	3–47	NS
Preoperative FSIQ		86.0	53–126		87.3	46–135	NS
Unitemporal IEDs	122 (68.9%)			29(74.4%)			NS
Early postoperative spikes	53 (29.9%)			25(64.1%)			$p < 0.001$
Preoperative GTCS							
Less than 2/yr	121(68.4%)			31(79.5%)			NS
Hx of febrile seizures	55 (31.1%)			4(10.3%)			$p = 0.008$
Hx of head injury	18 (10.2%)			6(15.4%)			NS
Hx of CNS infection	33 (18.6%)			11(28.2%)			NS
Days after surgery for EEG		10.7	4–29		9.3	3–25	NS

CAH: corticoamygdalohippocampectomy, SAH: selective amygdalohippocampectomy, NS: no significance, IEDs: interictal epileptiform discharges, Hx: history, FSIQ: full scale IQ, GTCS: generalized tonic clonic seizure, CNS: cnetral nervous system.