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Long-term outcome of epilepsy surgery: A retrospective study in a population of 379 cases

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Summary We evaluated the long-term outcome of epilepsy surgery in drug-resistant epilepsy patients, and investigated preoperative factors associated with postoperative long-term surgical outcome. We performed a retrospective study of 379 patients who received epilepsy surgeries from 2000 to 2010. Patients had completed a minimum of 2-year and up to 12-year follow-up. Preoperative evaluations, surgical outcomes and clinical data of patients were collected and analyzed. We found that the epilepsy surgery was effective in drug-resistant patients and the long-term outcome of epilepsy surgery was satisfactory. The bipolar electro-coagulation could improve the surgical outcome when the epileptogenic focus was on the functional cortex. Results of the 2-year follow-up showed that preoperative seizure characteristics including the history of febrile seizure, seizure frequency, and location, quantity and range of seizure foci were significantly associated with the surgical outcome. The surgery procedure including the surgery type and the extent of resection also affected outcome. Abnormal head or hippocampus MRI, inconsistent results of preoperative investigations, seizure types, and pathology type might also be predictors of long-term surgical outcome.

Abbreviations: AED, anti-epileptic drugs; AFR, anterior frontal resection; AH, amygdalohippocampectomy; ATL, anterior temporal lobectomy; CT, computed tomography; DEFC, dipolar electro-coagulation on functional cortex; EEG, electroencephalogram; FR, frontal resection; HS, hippocampal sclerosis; MRI, magnetic resonance image; PET, positron emission tomography; SGTCS, secondarily generalized tonic—clonic seizures; SPECT, single photon emission computed tomography; VEEG, video electroencephalogram; VNS, vagus nerve stimulation.

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Introduction

Despite appropriate treatment with anticonvulsive drugs, about 20—30% of epileptic patients still suffer from seizure (Annegers et al., 1979; Group, 1992; Cockerell et al., 1995; Kwan and Brodie, 2000). For these drug-resistant patients surgery is a therapeutic option. Data from multiple sources suggest that between 55% and 70% of patients underwent temporal resection and 30—50% of patients underwent extra-temporal resection become completely seizure-free (Kwan and Brodie, 2000). A prospective, randomized, controlled trial aimed to assess the efficacy of surgery for temporal lobe epilepsy showed that 58% of patients in the surgery group were seizure-free compared to 8% of those in the medical group (Wiebe et al., 2001).

Surgery is considered a valuable option for medically intractable epilepsy even in the absence of a proven drug resistance (Engel et al., 2003). Surgical outcome may be greatly influenced by the prognostic indicators (Berg et al., 1998). A review of temporal resections suggested that good surgical outcome was associated with a number of factors including hippocampal sclerosis, localization of interictal epileptiform activity, absence of preoperative generalized seizures, and absence of seizures in the first postoperative week (McIntosh et al., 2001). In 2001, it was estimated that there were more than 4 million people worldwide who could benefit from epilepsy surgery, but only less than 0.1% of the potential candidates actually received surgery every year (Sakamoto et al., 2001). Although in the past decade, criteria and guidelines have been developed for identifying patients who need epilepsy surgery, a recent update on epilepsy surgery has suggested an underutilization of surgery in drug-resistant patients (Kwan and Brodie, 2000). Comprehensive prognostic indicators are urgently needed.

Assessment of long-term outcomes is essential for epilepsy surgery because it is an irreversible procedure and has a chronic effect on the life quality. Earlier studies were limited because they focused more on a single surgery type and only a few preoperative risk factors that might be associated with the outcome of epilepsy surgery were evaluated. In this report, we present a long-term follow-up study of a large cohort of patients who received surgeries operated by neurosurgeons having extensive experience in epilepsy surgery in the First Affiliated Hospital of Harbin Medical University. This retrospective study reviewed outcomes of surgeries performed by the same neurosurgeons, therefore, it minimized the variations caused by surgical operations. We performed follow-up interviews on those patients who underwent epilepsy surgery up to 13 years ago and investigated possible predictors related to a good outcome of surgery, such as operation type and risk factors exiting in the pre-surgery and post-surgery periods. This study provides new insight on major implications relevant to the effectiveness and long-term clinical outcomes of epilepsy surgery.

Methods

Study population

To identify study candidates, we reviewed all the cases in the Fourth Neurosurgery Center of the Affiliated Hospital of Harbin Medical University. In this study, we initially collected clinical charts of 435 patients who were poorly controlled by medication and received surgery performed by Dr. Zhiguo Lin and Dr. Hong Shen in the Center from 2000 to 2010. Among 435 patients, 379 returned for 6-month and 2-year follow-up. We performed a retrospective review of clinical data of these 379 patients. The maximal time span of the long-term follow-up was 12 years. This study was approved by the ethnics committee of The First Affiliated Hospital of Harbin Medical University.

Table 1 Record of pre-surgical evaluations for 379 patients.

Characteristics	Number (%)
Female/male	184/195
Investigation	
EEG	379 (100%)
24h-VEEG	379 (100%)
Head CT	301(80%)
Head or Hippocampus MRI	357 (94%)
Head SPECT	103 (27%)
Head PET-CT	127 (34%)
Intro-operation ECoG	379
Intro-operation deep electrodes	289 (76%)
Pathology	349
Complication	70

Pre-surgical evaluation

Detailed clinical data were collected from patients who were considered possible candidates for epilepsy surgery. The procedure of pre-surgical evaluation for epileptic patients is described below. Resistance to first-line antiepileptic drugs (AED) was evaluated. High resolution head and hippocampal MRI were performed as a routine procedure. MRI images were obtained using a Phillips Magnetom Impact 1.5 or 3.0 T scanner. All MRI results included T1-weighted three-dimensional volume, proton-density, FLAIR and T2-weighted images. All patients underwent continuous video-EEG (VEEG) monitoring lasting at least 24 h. A summary of pre-surgical evaluations of patients is presented in Table 1.

All 379 patients received AED for a minimum of 2 years post operation. The dosage and the type of AED remained unchanged unless the patients developed side-effects within 2 years. After 2 years, patients were subject to a reduction in dosage or a complete discontinuation of AED according to individual condition.

Data collection

Clinical and personal data for each patient were documented in the case file. The long-term outcomes of epilepsy surgery were obtained by phone interview or mailed questionnaire. Patients who had died were considered lost to follow-up.

In this study, we investigated the following variables that have been shown to be important in pre-surgical evaluations