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Low-grade temporal gliomas: Surgical strategy and long-term seizure outcome

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ABSTRACT

Low-grade gliomas (LGGs) are generally located in temporal lobe and cause medically-intractable seizure so that surgical treatment becomes inevitable. This study includes a retrospective analysis of our patients with temporal LGGs retrieved from our epilepsy surgery data base and tries to present appropriate surgical approach and long-term seizure and anti-epileptic drug (AED) outcomes. Fifty-three patients including children and adults underwent surgery on temporal lobe LGGs and 35 patients were reached to report seizure and AED outcomes. On the non-dominant temporal lobe, anterior temporal resection with hippocampectomy whether mesial structure are involved or not is the appropriate approach. On the dominant temporal lobe mesial structures should be respected. However, total resection of the tumor should be the goal of surgery. Mean follow-up period was 8.3 years and favorable seizure outcome was found to be 91.4%. Surgery decreased AED usage and mean number of AED significantly decreased. Children also benefited from surgery as adults. Surgical treatment of tumor-related epilepsy from temporal lobe controls seizures, and total removal should be the main goal of surgery as neuropsychological testing permit.

1. Introduction

It is well known that almost 10–40% of the supratentorial tumors manifest epileptic seizures as a sole symptom and the majority is generally diagnosed as low-grade gliomas (LGG) [1]. Temporal lobe is the most common location for LGGs which cause complex partial seizures. The association between seizure and such tumors has been the focus of epileptologists and/or epilepsy surgeons after Huglings Jackson's report in 1880s [2]. Limited clinical studies from several epilepsy centers around the world specifically report favorable seizure outcome in patients who had surgery on temporal LGGs, but unfortunately there is still no standard surgical approach [3–11]. Some suggest anterior temporal resection [3] with hippocampectomy but others advocate extended lesionectomy [6] since favorable seizure outcome is almost the same whether hippocampectomy is added or not. More importantly, it has been demonstrated that even subtotal resection of temporal LGGs can leave the patients with favorable seizure outcome and they claim that it is unnecessary to remove mesial structures because of fear of severe memory problems [12]. Whatever the surgical strategy is, it is obvious that every epilepsy center has its own method and freedom from the seizure seems to be the most important criteria for the successful surgery.

There have been limited numbers of clinical studies reporting the long-term seizure outcome of chronic epilepsy associated with temporal LGGs [3–11] and we wanted to contribute to the current literature by reporting the long-term surgical outcome of our 53 patients who had undergone surgery on temporal LGG.

2. Materials and methods

This retrospective study provides surgical outcome of patients who were operated on temporal lobe LGGs between 2000 and 2013, November. All patients were reviewed from the epilepsy surgery database with respect to clinical and radiological findings. Seizure and anti-epileptic drug (AED) outcome were evaluated by making phone call and seizure outcome was classified according to Engel classification [I: seizure free without aura; II: rare seizures (≤2/year); III: ≥75% decrease in seizure frequency; IV: no worthwhile improvement] [13]. In order to give homogenous results

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Table 1
Summary of clinical findings of 53 patients operated on low-grade temporal lobe gliomas.

Parameter	Number of cases/%
Female	21/39.6
Male	32/60.4
Mean age (year)	23.4 ± 4 (2–63 years)
Seizure at onset (year)	15.7 ± 12.3 (1–62 years)
Seizure frequency/month	29.0 ± 58.8 (1–300)
Duration between seizure onset and surgery (year)	7.6 ± 6.6 (1–23 years)
Seizure type	
Complex partial	32/60.4
Generalized tonic-clonic	14/26.4
Others[a]	7/13.2
Electroencephalography (EEG) findings	
Lateralized	33/62.3
No EEG	16/30.2
Bilateral hemispheric	3/5.6
Normal	1/1.9
Hemispheric dominance	
Right	3/5.6
Left	50/94.3
Mean follow-up	8.3 ± 3.4 (1–13 years)

[a] Includes absence and secondary generalized seizures.

we had some criteria as follows: (1) temporal lobe involvement only; (2) presence of preoperative magnetic resonance imaging (MRI); (3) at least 1 year clinical and radiological follow-up and (4) patients operated by epilepsy surgeons who have almost the same surgical strategy. Locations of the tumors were divided into (1) *mesial*–mesial to the collateral sulcus; (2) *lateral*–lateral to the collateral sulcus and 3) the *whole temporal lobe* if both mesial and lateral parts were involved. All patients had MRI within 24 h of surgery and in every year of follow-up, MRI was also obtained in order to see any recurrence. Volumetric measurements for defining the extent of resection were assessed on postoperative MRI, especially on FLAIR-weighted images.

3. Results

Reviewing the database between 2000 and 2013, November showed a total of 75 patients operated on temporal LGG, but 53 could meet our criteria. Clinical findings of 53 patients (children and adult) were shown in Table 1. Clinical findings were found to be in line with the current literature. Males are more affected than females but no significant difference was obtained (χ^2 test; $p = 0.1$). These patients are generally young and admit to the hospital with frequent seizures. We have to underline that there is still a long delay between the seizure onset and surgery, which was found in the current study, and which was almost 8 years. As expected the most common seizure type is complex-partial seizure (χ^2 test; $p = 0.00001$) and preoperative electroencephalography (EEG) lateralize the lesion in majority of patients. In this study, right hemisphere was the dominant side for the memory for 3 out of 53 patients depending on the neuropsychological testing and we had long-term follow-up which was almost 8 years.

Radiologically, almost all tumors were hypointense on T_1-weighted and hyperintense on T_2-weighted and FLAIR MRI sequences. Side preferences were left in 28 (52.8%) and right in 25 (47.2%) but no significant difference was found (χ^2 test; $p = 0.6$). Considering the sub-location, the majorities involved only the mesial structures, which were seen in 31 (58.5%) patients. Nine patients (17%) showed lateral neocortex involvement and the whole temporal lobe was involved in 13 (24.5%) patients. The statistical comparison showed significant difference with respect to sub-location (χ^2 test; $p = 0.00001$).

As our epilepsy surgery policy, extend of resection on the temporal lobe LGGs mainly depend on three factors: (1) proximity to the mesial structures (here amygdala, hippocampus and parahippocampus); (2) involvement of the mesial structures and (3) hemispheric dominance (Fig. 1). Actually, our surgical approach is straightforward on the non-dominant hemisphere: anterior temporal resection with hippocampectomy whether the mesial structures are involved or not. On the other hand, on the dominant hemisphere our surgical approach mainly depends on neuropsychological testing (neuropsychological battery plus WADA testing before 2008 and fMRI replaced WADA since then): we generally perform extended lesionectomy if mesial structures are not involved. In case of mesial structure involvement solely, we perform partial removal if severe memory problems will occur. EEG findings were generally found to be concordant with the side of the lesion. Our surgical approach is not affected by EEG findings if EEG does not point extremely unusual locations. Table 2 demonstrates the summary of surgical findings. We had tendency to perform total resection in order to have favorable seizure outcome and to decrease the chance of recurrence and tumor upgrade (total vs. subtotal; χ^2 test; $p = 0.00001$). As seen in the Table 2, on

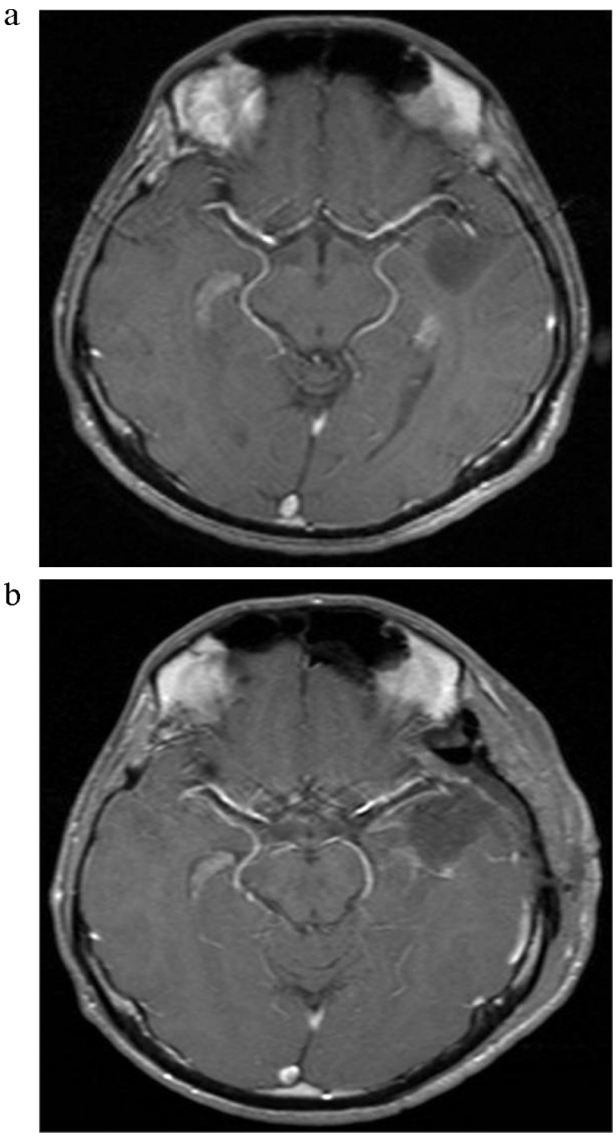

Fig. 1. Preoperative axial T_1-weighted contrasted MRI (a) shows a hypointense lesion located close to but not involved the mesial structures on the left temporal lobe. Lesionectomy because of the dominant hemisphere was performed and histopathological diagnosis was oligodendroglioma (grade II). No recurrence was found on axial T_1-weighted contrasted MRI after 3 years (b).