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Predictors of unprovoked seizures in surgically treated pyogenic brain abscess: Does perioperative adjunctive use of steroids has any protective effect?

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ABSTRACT

Objective: Though outcome of brain abscess has been improved due to stereotactic drainage and appropriate antibiotic treatment, late unprovoked seizure often occurs after the abscess is resolved. The purpose of this study is to reveal the factors related to the late unprovoked seizure and effect of steroid on the prevention of seizure.
Patients and Methods: From January 2002 to August 2016, 119 patients with supratentorial brain abscesses were retrospectively analyzed. Initial volume of abscess, surgical methods, use of antiepileptic drugs (AEDs), and seizure free survival according to the use of steroid were compared between seizure free and late unprovoked seizure patients groups. Factors related to the late unprovoked seizure were evaluated by multivariate logistic regression model.
Results: All patients underwent surgery, which were either by burrhole aspiration or craniotomy. 22/119 patients (18.5%) had late unprovoked seizure. Initial abscess volume was significantly larger in the group of late unprovoked seizure (28.31 ± 22.68 cm^3 vs. 17.03 ± 14.53 cm^3, p = 0.015). The mean time to the late unprovoked seizure was 487.7 ± 446 days (range, 11–1369 days). Steroid was used to relieve perilesional edema in 35 patients. Proportion of late onset seizure was not different between the group of steroid non-use group and steroid use (17.1% vs. 19%, p = 0.52) and mean seizure free periods of steroid non-use group and steroid use group were 40.75 ± 9.23 months and 48.85 ± 8.50 months, respectively (P = 0.89, by log rank test). Initial presentation of seizure at the diagnosis of brain abscess and initial volume larger than 20.89 cm^3 were risk factors for late unprovoked seizure with odds ratio of 4.1 (95% C.I 1.44–11.69) and 3.08 (95% C.I 1.19–7.96), respectively.
Conclusion: Late unprovoked seizure in patients with brain abscess was affected by initial presentation of seizure and initial volume of the abscess whereas methods of surgical intervention and steroid use had no effect on the occurrence of late unprovoked seizure.

1. Introduction

Despite the improvement of the mortality due to the stereotactic drainage, imaging technologies, and early antibiotic treatment in the management of brain abscess, unprovoked seizure remains an important complication to which clinicians should pay attention during follow-up [1,2]. Postoperative seizures may result in ictal injury, decreased cognitive function, and even death [3].

As perilesional edema has been known to be the causative factor of epileptic seizure in the patients with brain tumor [4–6], steroid has been commonly used in the management of brain abscess to reduce cerebral edema [7]. However, there has been no report to evaluate effect of steroid to control seizure, which may lead to unnecessary overuse of steroid in the patients with brain abscess. In this study, we analyzed the potential factors associated with unprovoked seizure after the surgical intervention of brain abscess and evaluated whether perioperative steroid can affect the occurrence of late unprovoked seizure.

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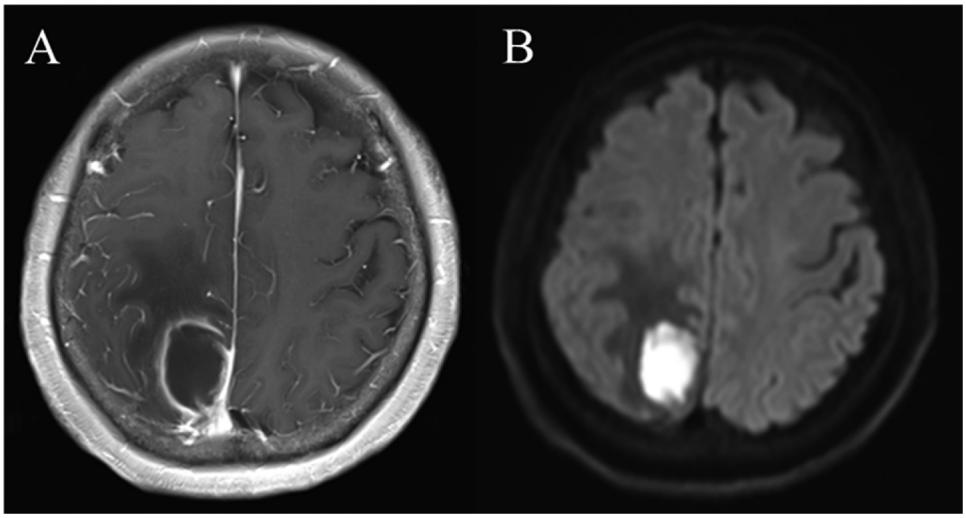

Fig. 1. Preoperative axial post-contrast T1-weighted MRI (A) and diffusion weighted axial MRI images showing mass lesion of the right occipital region with diffusion restriction.

2. Materials and methods

2.1. Characteristics of the patient and abscess

A search of institutionaldatabase at our institute was conducted to identify the brain abscess located in the supratentorial region from January 2002 to August 2016. This study was approved by the institutional review board of our facility (IRB 2016-1081). All brain abscesses were treated by the surgery followed by antibiotic treatment.

All brain abscesses were defined as localized collection of pus identified by surgical aspiration which is shown as a localized lesion accompanied with high signal intensity on diffusion weighted image of magnetic resonance imaging (MRI) (Fig. 1). Locations of abscesses were classified according to the anatomical location of the brain. The abscesses located in the basal ganglia, thalamus, or brain stem were classified as a 'deep seated'.

The following was reviewed: patients' characteristics, presence of seizure and type of seizures at first presentation, location and volume of brain abscess, the use of steroid during treatment period, time to late unprovoked seizure. Late unprovoked seizure was defined as that occurred 7 days after the first diagnosis of brain abscess [8]. Trauma-related or hospital acquired cases, cases with fungal infection or tuberculoma and abscesses that were preceded by neurosurgical procedures or head trauma were excluded.

2.2. Measurement of the abscess volume

Brain abscess volume was measured using Pentavision for Clinics software (Medical image laboratory, Asan Medical Center, Seoul, Korea). Enhancing wall of brain abscesses was annotated slice by slice on axial images of post contrast T1-weighted magnetic resonance imaging (MRI) or computerized tomography (CT) as Baris et al did in their study [9] and all slice areas were automatically integrated by the software to calculate abscess volume. In the cases of multiple abscesses, volumes of all abscesses per patient were added to calculate the total volume.

2.3. Surgical intervention and abscess culture

Surgical procedures were conducted either by burrhole aspiration or craniotomy followed by stereotactic abscess drainage. The surgery was performed to maximally drain the abscess material. All abscess samples were transported to the microbiology laboratory of our center for microscopy, culture, and antibiotics-sensitivity test according to the laboratory's standard operative procedure.

2.4. Antiepileptic drugs(AEDs) and perioperative steroid use

AEDs were used according to the clinician's preference regardless of the presence of seizure at the first diagnosis of brain abscess. Though clinicians' observational criteria of severity of perilesional edema on the preoperative image studies were subjective, the use of adjunctive steroid was also determined according to the treating clinician's preference.

2.5. Patient follow-up

All patients were followed up in our outpatient department with a neurological examination and history taking of the occurence of seizure. Iodinated contrast-enhanced brain CT or MRI with gadolinium enhancement was performed in all patients at three to six months after surgical intervention. Time to late unprovoked seizure was measured from the first diagnosis of brain abscess to the first episode of seizure during the follow-up periods.

2.6. Statistical analysis

Statistical Packages for Social Sciences (SPSS) version 22.0 (IBM SPSS, Armonk, NY, USA) was used for statistical analysis. The normality of data was tested using the Kolmogorov-Smirnov method. Mann-Whitney *U* test was used to evaluate statistical significant differences between mean values of continuous variables. Chi-square test was performed to determine significance between categorical variables; p-values 0.05 were regarded as statistically significant. Seizure free survival between groups of steroid use and non-use was calculated by Kaplan-Meier's method and compared by log rank test. A Cox's proportional hazards model was performed with univariate and multivariate model for the association of late onset seizure and clinical variables.

3. Results

3.1. Patient characteristics

A total of 131 brain abscesses in 119 patients (7 cases of multiple abscesses) were identified by brain MRI with gadolinium enhancement and pathologically confirmed by surgical drainage. Of these, 84 patients (70.6%) were male and 35 (29.4%) were female, with a male:female