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■ Case report ■

A case of hippocampal sclerosis diagnosed as cortical dysplasia due to preoperative brain MRI finding

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= Abstract =

Hippocampal sclerosis (HS) is one of the most common features of intractable temporal lobe epilepsy. Generally it can be identified through brain magnetic resonance imaging (MRI) with high degree of sensitivity and specificity. Typical brain MRI findings of HS are hippocampal atrophy with hyperintense signal confined to the lesion. On the other hand cortical dysplasia exhibits blurring of the gray-white matter junction and abnormal white matter signal intensity. We present a case where preoperative brain MRI strongly suggested the presence of diffuse cortical dysplasia in the left temporal lobe but postoperative pathology revealed the temporal lesion to be unremarkable except for hippocampal sclerosis. (Korean J Pediatr 2010;53:106-110)

Key Words : Hippocampus, Cortical dysplasia, Epilepsy, Surgery, MRI

Introduction

Clinical manifestation of focal epilepsies are dependant on the underlying cause, and correct identification of the lesion with proper epileptic classification are indispensable in predicting the clinical outcome and correct method of treatment. In approximately 25% of focal epilepsies, seizures are not adequately controlled by antiepileptic medications [1]. Seizure control is especially difficult if structural abnormalities are seen in brain MRI, and in such symptomatic cases, the possibility of achieving successful seizure control with use of antiepileptic medication only is minimal. Even if the seizures are controlled, recurrence is common upon discontinuation of antiepileptic medications. Surgical resection of the symptomatic lesion can drastically increase the therapeutic efficacy, and if the structural abnormalities as observed in MRI are resected completely, rate of therapeutic success is known to be as high as 60-80%[2].

Hippocampal sclerosis is one of the most common pathologic causes of refractory focal epilepsy among young adults and is known to be associated with complicated febrile convulsion earlier in life. Cortical dysplasia on the other hand is one of the most common causes of extratemporal focal epilepsy and is formed by disturbance of stem cell proliferation or cortical organization.

We report a case where pre-operative MRI finding strongly suggested the presence of diffuse temporal lobe cortical dysplasia but post-operative pathological analysis showed no abnormal features in the resected lobe save for hippocampal sclerosis.

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Case report

16 year old male has been in an orphanage for 5 years. His development was noted to be markedly delayed at 3rd grade of primary school, he was diagnosed with third degree mental retardation. A year later he began to suffer repetitive generalized tonic clonic seizures, frequently lasting more than 20 minutes. He was treated with antiepileptic medications only without receiving any diagnostic work-up or regular follow-up by a child neurologist. Within 6 months of admis-

sion at the age of 15 years, he was adopted by his aunt, where his intractable epileptic nature was called to attention. He was admitted to the department of pediatrics of Severance Children's Hospital for proper evaluation of his generalized tonic clonic seizures. Initial intelligence test showed severe mental retardation (IQ below 30) and his neurological examination was normal. MRI were acquired using T1 and T2 weighted images, spoiled gradient echo (SPGR), fluid attenuation inversion recovery (FLAIR) and fast inversion recovery for myelin suppression (FIRMS). FLAIR images showed abnormal signal intensity in the white matter of left temporal lobe (Fig. 1A), T2 weighted coronal image showed blurring of the gray-white matter junction and abnormal signal intensity of left temporal lobe (Fig. 1B). 2-Deoxy-2[18F]fluoro-D-glucose (FDG) PET was performed to him. Based on asymmetries between homologuous cortical areas in FDG PET images, Axial (Fig. 1C) and Coronal (Fig. 1D) 18F-FDG PET images show asymmetric decreased uptake of Fluorine-18 on left temporal lobe. Diffusion tensor imaging showed well-innervated corticospinal tract without overt evidence of asymmetry. Subtraction ictal SPECT coregistered on MRI (SISCOM) analysis was unremarkable except for subtle increased difference of flow between ictal and interictal ictal perfusion 99mTc-ethyl cysteinate dimmer (ECD) single photon emission computed tomography (SPECT) in the left temporal area. On 24 hour scalp electroencephalographic (EEG) monitoring, high amplitude rhythmic sharp waves were noted in left sphenoidal electrode, with slowing of the background activities in left temporal area. The patient was diagnosed as diffuse cortical dysplasia in left temporal lobe with symptomatic epilepsy originating from left temporal lobe and surgical treatment was decided. For subdural EEG monitoring, 3 Grids designated AT (4×8), ST (2×8), PT (2×8) were inserted in the temporal, supratemporal, and posterior temporal area (Fig. 2A). Countless ictal discharges erupting from AT6, 7, 19, 20 that promptly spreaded to adjacent leads (AT 14-16, AT 21-24) (Fig. 2B). Left temporal

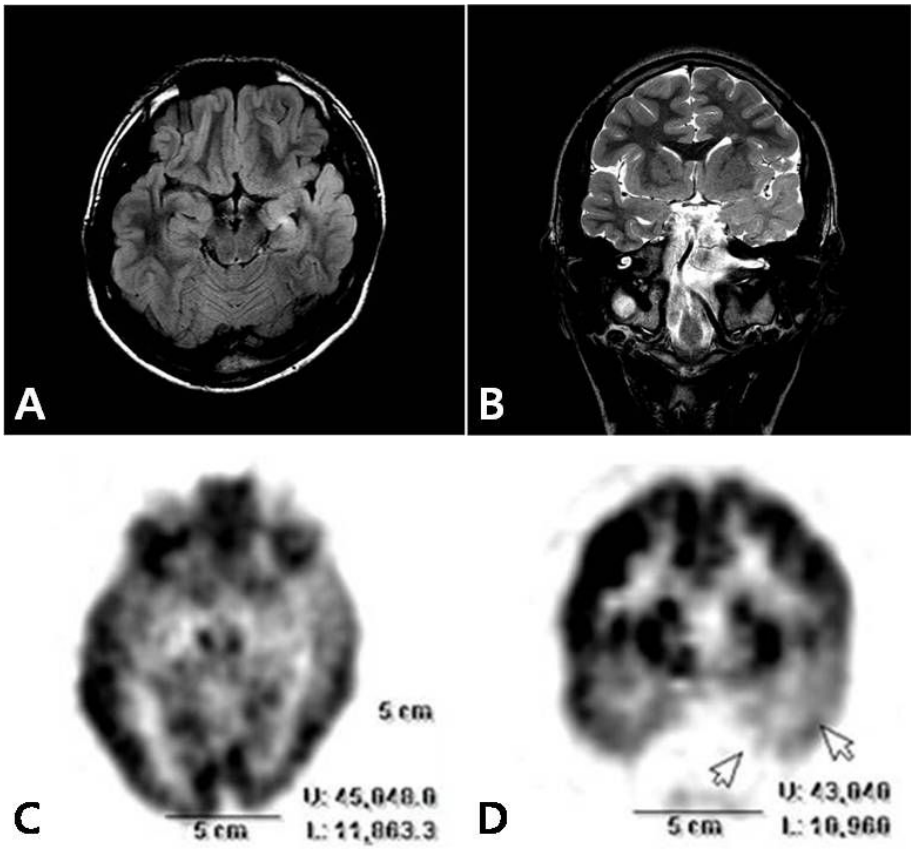

Fig. 1. (A) FLAIR axial image shows abnormal signal intensity in the white matter of left temporal lobe, (B) T2 weighted coronal image shows blurring of the gray-white matter junction & abnormal signal intensity of left temporal lobe. (C) Axial and (D) coronal 18F-FDG PET images show asymmetric decreased uptake of Fluorine-18 on left temporal lobe.

lobectomy with selective amygdalo- hippocampectomy was performed. Post-operative pathological finding showed left temporal lobe of normal cortex and white matter without large dysplastic neuron (Fig. 3A) and only little amount of focal neuronal loss, consistent with hippocampal sclerosis (Fig. 3B). Two years after his surgical procedure, the patient is seizure-free and aggravation of previous cognitive or language impairment was not present.

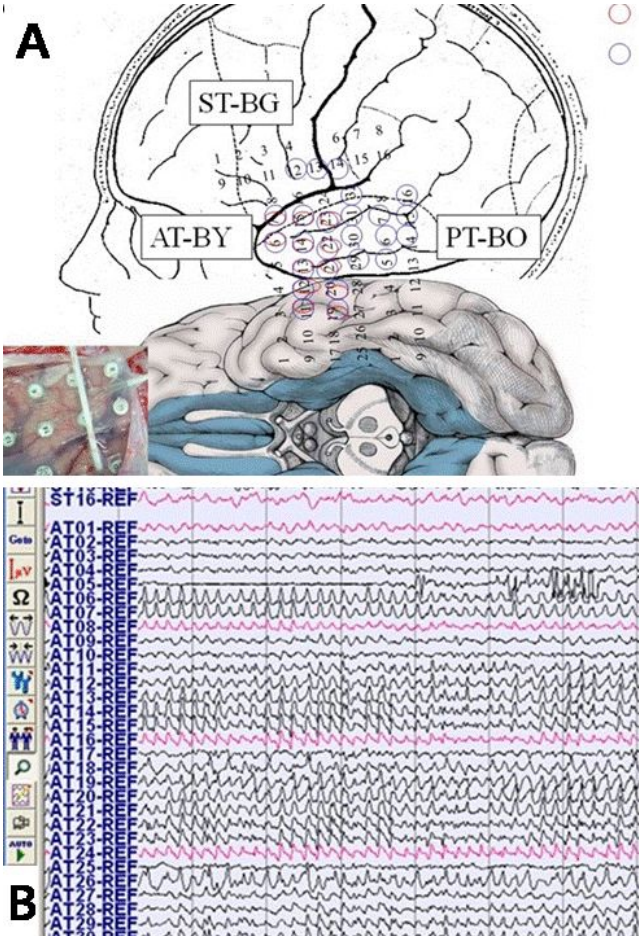

Fig. 2. (A) 3 Grids designated AT (4×8), ST (2×8), PT (2×8) were inserted in the temporal, supratemporal and posterior temporal area. (B) Countless ictal discharges erupting from AT 6, 7, 19, 20 that promptly spreaded to adjacent leads (AT 14-16, AT 21-24).

Discussion

Hippocampal sclerosis is the single most common pathological finding seen in young adults with refractory focal epilepsy. Unilateral mesial temporal lobe epilepsy due to hippocampal sclerosis, in particular, is considered to be the prototype of surgically curable focal epilepsy syndrome [1].

In both children and adults, hippocampal sclerosis is less frequently detected by MRI at the onset of temporal lobe epilepsy as compared to chronic refractory temporal lobe epilepsy[3-5]. The low prevalence of hippocampal sclerosis in early childhood suggests that MRI-detectable hippocampal sclerosis might be part of a multistage or progressive changes[6].

On structural MRI the main features of hippocampal sclerosis are hippocampal atrophy and increase in signal intensity of hippocampus on FLAIR or T2-weighted images[7]. This unilateral major imaging features of hippocampal sclerosis are not prevalent in nonepileptic patients[8], perhaps with the exception of some nonsymptomatic family members in pedigrees with familial mesial temporal lobe epilepsy[9].

Bilateral MRI features of hippocampal atrophy with or without hippocampal T2 hyperintensity might be non-specific changes following major brain injury (hypoxia, trauma) or in the setting of global cerebral atrophy (old age, dementia or chronic psychiatric disease)[10].

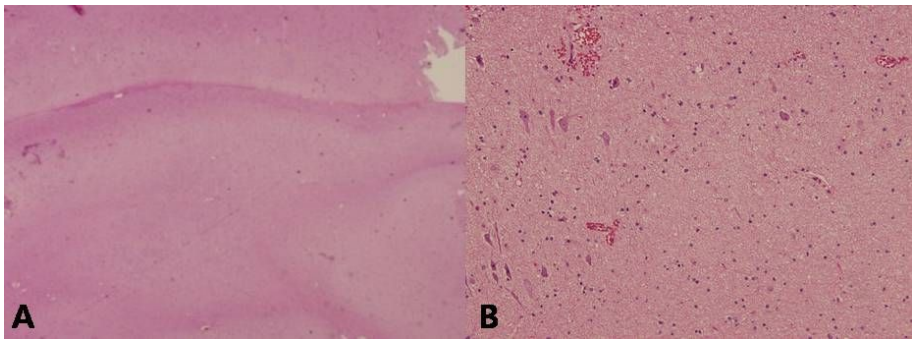

Fig. 3. Microscopically, (A) Left temporal lobe and hippocampus showed normal cortex and white matter without large dysplastic neuron (H and E staining ×12). (B) Focal neuronal loss is noted with hippocampal sclerosis. (H and E staining, ×100).

The differential diagnosis of unilateral or bilateral hippocampal hyperintensities on FLAIR or T2-weighted images includes normal variants (choroid fissure cyst, cysts of the hippocampal sulcus remnant), encephalitis and edema following status epilepticus. But in contrast to Hippocampal sclerosis, the hippocampi or amygdalae appear to be swollen in acute diseases like encephalitis or post-status condition. Follow-up imaging may be necessary in such cases.

Hippocampal sclerosis may occur in association with other lesions[11] as dual pathology. Most common dual pathology associated with hippocampal sclerosis is early ischemic lesion,

Hemiatrophy, low-grade tumors, vascular malformations and malformations of cortical development have also been found frequently in such conditions[12]. In MRI images the most frequently detected dual pathology is blurring of the interface between gray and white matter in the temporal pole, which can be found anterior to hippocampal sclerosis in up to 60% of cases[13]. It is, however unclear whether the temporopolar "blurred gray-white matter interface" in temporal lobe epilepsy with hippocampal sclerosis can always be considered to represent focal cortical dysplasia[14] or whether there might exist other cortical lesions, such as ectopic white matter neurons[15, 16], gliosis[17], myelin abnormality[18, 19], or even unspecific histopathological findings [15].

Focal cortical dysplasia is probably the most common cause of refractory extratemporal focal epilepsy especially in children[20]. Focal cortical dysplasia has also been associated with MRI-negative focal epilepsy in adults[21]. In the diagnosis of focal epilepsy, the prevalence of focal cortical dysplasia ranges between 5 and 25%[22]. A high index of suspicion should be maintained especially in children with extratemporal "catastrophic" epilepsy, which does not fit into the classification of benign focal epilepsies of childhood[22].

After 24 months of age, focal cortical dysplasia can be identified by looking for very circumscribed and subtle cortical/subcortical T2 hyperintensity (especially on FLAIR images), blurred interface between gray and white matter or focal cortical thickening. Other findings associated with cortical changes include transmantle sign, which manifests as a T2 hyperintense signal in the subcortical white matter that tapers as it extends to the lateral ventricle. These signs are best observed in FLAIR and proton density images[20, 23]. Transmantle sign can also help to distinguish focal cortical dysplasia from wedgelike low-grade tumors on brain MRI[15].

Our patient showed blurring of the gray-white matter junction in the left temporal lobe with abnormal signal intensity in the white matter, which strongly hinted at diffuse cortical dysplasia of the left temporal lobe. Post-operative pathological review however did not find any abnormalities except for hippocampal sclerosis.

One reason for this discrepancy may be "diaschisis", a term coined by Constantin von Monakow in early 20th century, which states that a certain damaged area of the neural system can have an adverse effect on other areas of the system located distantly. In recent times the term diaschisis is used to describe a depression of regional neuronal metabolism and cerebral blood flow caused by dysfunction in an anatomically separate but functionally related neuronal region. It appears that our patient exhibited a dramatic case of diaschisis of the hippocampal diaschisis presenting as temporal cortical dysplasia. Imaging analysis when applied to correct symptomatic epileptic patient group, provides valuable information in establishing correct surgical treatment, but as this patient shows, the results may be falsely positive. These false positive results, however, do not seem to affect the post-surgical outcome and we believe that operative intervention based on imaging analysis is called for regardless of final pathological result.

한 글 요 약

수술 전 뇌 자기공명 영상에서 겉질 형성이상증 소견 보였으나 수술 후 병리학적으로 확인된 해마경화증 1례

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해마경화증은 난치성 측두엽간질의 가장 흔한 원인들 중 하나이다. 일반적으로 해마경화증은 뇌 자기공명영상에서 높은 민감도와 특이도로 규명될 수 있다. 이 병변의 뇌 자기공명영상 소견은 해마에 국한된 조영증가와 이와 연관된 위축된 해마 소견이라 할 수 있다. 반면에 국소성 겉질 형성이상증은 회백질-백질 경계부의 불분명함, 백질 부분의 이상 조영증강 소견을 보인다. 저자들은 수술적 치료 이전에 뇌 자기공명 영상에서 좌측 측두엽의 겉질 형성이상증의 소견을 보였으나, 수술 후 병리검사에서 해마경화증 외에 정상소견을 보였던 1례를 경험하였기에 보고하고자 한다.

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