Case Report

Ictal SPECT-guided Epilepsy Surgery in a Patient with Forme Fruste Tuberous Sclerosis

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Tuberous sclerosis is an autosomal dominant disease characterised by hamartomas (tubers) in many organ systems and the four major intracranial manifestations including cortical tubers, white matter abnormalities, subependymal nodules and subependymal giant cell astrocytoma. But there is immense variability in the clinical presentation of tuberous sclerosis and many incomplete forms (formes frustes) exist. Almost all patients with tuberous sclerosis have seizures and mental retardation. The authors experienced a 7-year-old boy with medically intractable epilepsy without any skin lesion or mental retardation. In terms of surgical standpoint for determination of extent of resection, corticectomy on the overriding cortex of right premotor and lesionectomy of periventricular calcified lesion were performed according to ictal single photon emission computed tomography(SPECT), which showed hyperperfusion in the subcortical and calcified area. Histopathologic findings showed a few cytologically abnormal neurons with extensive gliosis, containing many Rosenthal fibers, reactive astrocytes and dense calcification, composing of abundant calcospherites which suggested forme fruste tuberous sclerosis. During the follow-up period of eighteen months, seizure was free after surgery.

KEY WORDS : Forme furste tuberous sclerosis · Epilepsy · Ictal SPECT · Corticectomy · Lesionectomy.

Introduction

Tuberous sclerosis is well known as a dominantly inherited condition characterized by dysplastic lesions of the cerebral cortex with calcified subependymal nodules, mental retardation, skin lesions and angiofibromas in various organs. Eighty percent have seizures, often beginning in the first year of life. However, there is immense variability in the clinical presentation of tuberous sclerosis. Here authors report a 7-year-old boy with medically intractable epilepsy since newborn without any abnormal skin lesions or mental retardation, who shows seizure free after ictal single photon emission computed tomography(SPECT)-guided surgery, verified as a incomplete forms, formes frustes tuberous sclerosis.

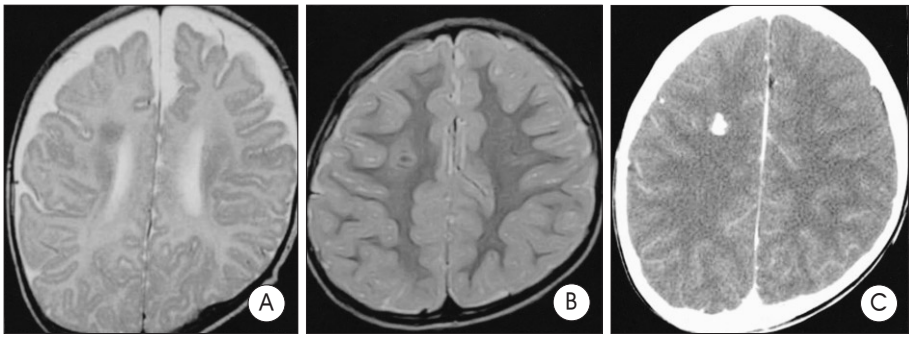

Fig. 1. Initial(3 month after birth, May 1996) brain magnetic resonance(MR) image showing a small periventricular lesion(A), which is changed as a more prominent calcified lesion in follow-up MR image (4 year-old, September 2000)(B) and recent computed tomography(7 year-old, February 2003)(C).

Case Report

The authors experienced a 7-year-old boy with medically intractable epilepsy since newborn without any skin lesion or mental retardation.

The brain computed tomography(CT) and magnetic resonance(MR) image showed right periventricular small calcified lesion with subtle enhancement(Fig. 1). The video-electroencephalography(EEG) monitoring with grid and depth electrodes on calcified lesion revealed no definite focal seizure onset. In terms of surgical standpoint for determination of extent of resection, corticectomy on the overriding cortex of right premotor area and lesionectomy of periventricular calcified lesion were performed according to ictal

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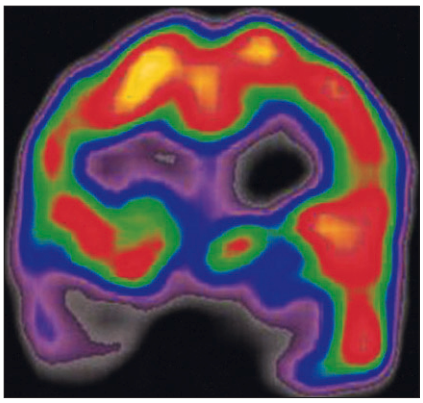

Fig. 2. Ictal single photon emission computed tomography shows abnormally increased perfusion areas on subcortical area above the calcified area of right frontal lobe.

SPECT, which showed hyperperfusion on subcortical and calcified area(Fig. 2). Histopathologic findings showed a few cytologically abnormal neurons with extensive gliosis, containing many Rosenthal fibers, reactive astrocytes and dense calcification, composing of abundant calcospherites which suggested forme fruste tuberous sclerosis(Fig. 3). During the follow-up period of eighteen months, seizure was free after surgery(Fig. 4).

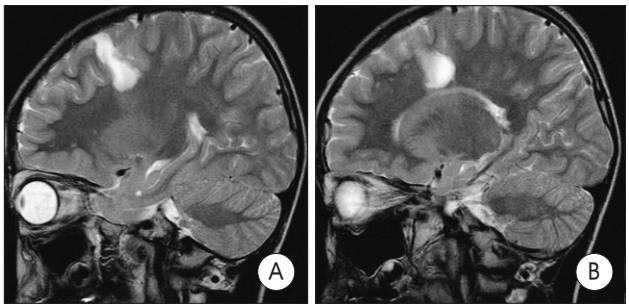

Fig. 4. In terms of surgical standpoint for determination of extent of resection, corticectomy based on ictal single photon emission computed tomography and ultrasound-guided lesionectomy of periventricular calcified lesion are performed(A, B).

Discussion

Tuberous sclerosis is an autosomal dominant disease characterised by hamartomas (tubers) in many organ systems that including the brain, retina, kidney, lung, heart, and skin. Classic triad of tuberous sclerosis are facial nevus(adenoma sebaceum), seizures, mental retardation.

Mutation of TSC1(9q34) or TSC2(16p13) is related to tuberous sclerosis[4,6]. The four major intracranial manifestations of tuberous sclerosis are cortical tubers, white matter abnormalities, subependymal nodules and subependymal giant cell astrocytoma.

The incidence of tuberous sclerosis is 1 in 27,000 overall, with an incidence in children of 1 in 12,000[5]. But there is immense variability in the clinical presentation of tuberous sclerosis and many incomplete forms(formes frustes) exist so the actual incidence may be as high as 1 in 5,800[5].

Epilepsy is the most common neurological symptom of tuberous sclerosis, occurring in 74 to 98% of patients and often begins during the first year of life[1,3,6]. As epilepsy in patients with tuberous sclerosis is often refractory to antiepileptic drugs and also difficult to localize the epileptogenic zone, usually regional or wide area, surgical resection is not so prevalent with unfavorable outcome[2,3].

Perot and Weir first reported successful epilepsy surgery in tuberous sclerosis patients in 1966 and some subsequent reports which demonstrate good outcome in approximately 50~60% of drug-resistant patients selected for surgical management[2,7].

Unfavourable prognostic factors include onset earlier than 1 year of age, presence of several seizure types(infantile spasms and partial motor or complex partial seizures ; drop attacks and atypical abscences), multifocal discharges and/or secondary bilateral synchrony, and occurr-ence of new EEG foci during the evolution[3,6,7]. Although Comair already mentioned about the seizure free cases with only PET-guided resective surgery without any other consistent findings to localize the epileptogenic zone, there is no similar report related resective surgery only ictal-SPECT guidance as far as we know. However, selected patients with tuberous sclerosis with medically

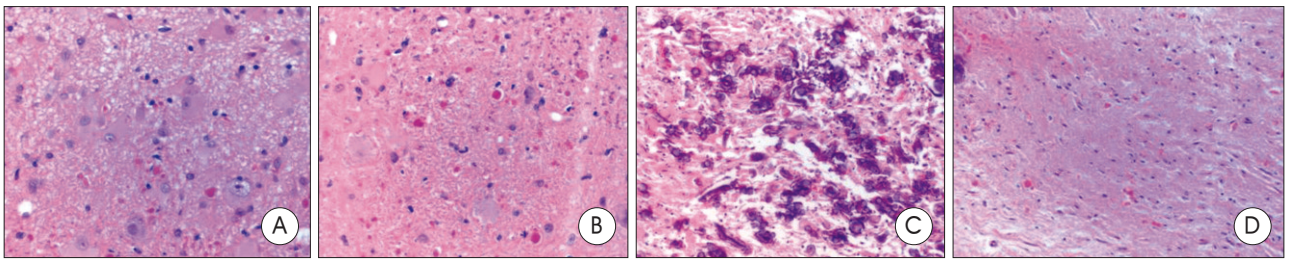

Fig. 3. The histopathologic findings show a few cytologically abnormal neurons with extensive gliosis, containing many Rosenthal fibers, reactive astrocytes and dense calcification, composing of abundant calcospherites which suggest forme fruste tuberous sclerosis(H&E, original magnification ×200). A : partial area of large, bizzare or multinucleated cells with prominent nucleoli and abundant eosinophilic cytoplasm, B : A conspicuous large globular cells with ample pink cytoplasm and eccentric nuclei, C : large areas of numerous calcospherites, D : extensive astrogliosis with Rosenthal fibers.

intractable epilepsy verified as localized focal epileptogenic focus especially by ictal SPECT, lesionectomy and/or corticectomy are recommended for better seizure outcome[1,3,6].

Conclusion

Although most patients with tuberous sclerosis have intractable seizures, surgical consideration is needed in selected cases based on sophisticated presurgical evaluation especially definitive ictal SPECT.

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