Alice in Wonderland Syndrome in a Child with an Electroencephalographic Abnormality: A Case Report

Alice in wonderland syndrome (AWS) is a paroxysmal disorder with distorted body image, including altered perceptions of size, mass, or shape. In fact, altered body image is the classic symptom of AWS. However, young children and adolescents younger than 15 years with AWS usually show visual symptoms, including micropsia or teleopsia. The most common visual symptom with AWS is micropsia. There are several theories of the etiology of AWS, the most popular of which is migraine. The second most frequently mentioned etiologic theory of AWS is that it is infection-induced. Finally, abnormal brain electrical activity, such as epilepsy, is another possible cause of AWS. We herein report a case of 9-year-old boy who was admitted with visual disturbances characterized by microteleopsia and pelopsia. He denied headache, but his mother had a history of migraine. His general physical examination was unremarkable. Brain magnetic resonance imaging did not show any abnormal findings, but an electroencephalogram showed abnormal discharges. The patient was prescribed an antiepileptic drug, which improved his symptoms.

Key Words: Alice in Wonderland syndrome, Electroencephalogram, Migraine

Introduction

The term Alice in Wonderland syndrome (AWS) was originally coined by Dr. John Todd in 1995. This syndrome is characterized by paroxysmal body image distortion with altered perception of size, mass, or shape\(^1\). Historically, the first person to mention this symptom was Caro Lippman in 1952\(^2\). The name of this syndrome is derived from the story of Alice's Adventures in Wonderland, which was written by Lewis Carroll in 1865. Lewis Carroll is known to have had migraine and is likely to have experienced this syndrome. Many AWS sensory symptoms are described in Lewis Carroll's story.

Lanska et al, classified AWS sensory abnormalities into three types: type A, type B, and type C\(^3\). Type A includes somesthetic symptoms, such as altered perception of body size. Visual symptoms, including micropsia (objects appear smaller than they are), macropsia (objects appear larger than they are), teleopsia (objects appear farther away than they are), and pelopsia (objects appear closer...
than they are), are classified as type B. Type C includes both somesthetic and visual symptoms.

Young children and adolescents typically develop visual symptoms, the most common of which are micropsia and teleopsia. It is believed that the most common etiology of AWS in children and adolescents is infection (33%) followed by migraine (6%) and head trauma (6%). One study reported that 4% of AWS cases were due to abnormal brain electrical activity such as epilepsy. AWS is characterized by perceptual distortions rather than hallucinations or illusions; therefore, AWS should be distinguished from psychotic disorders.

We herein report a case of a 9-year-old boy who presented with AWS associated with abnormal electroencephalographic findings.

**Case report**

A 9-year-old boy was admitted to the hospital because of the sudden onset of visual disturbances characterized by micropsia and pelopsia. The patient denied nausea, vomiting, and headache. The patient's guardian reported that the frequency of symptoms was about 2 to 3 times per week and the duration of each episode was about 5 to 10 minutes. The patient visited a local ophthalmology clinic, but his examination and visual test results were unremarkable. The patient had no history of fever during this time, although he had a history of one febrile seizure at 3 years of age. The patient had no significant medical history other than having occult blood in his urine two years ago. The only significant family history of neurologic disease was his mother's history of migraine.

On physical examination, the patient's heart rate was 89 beats/min and his blood pressure was 97/61 mm Hg. He was afebrile and his general physical examination was unremarkable. Neurologic examination showed that he was alert and oriented. His cranial nerve function was unremarkable, and his gait and the tandem gait were normal. His visual field exam was also normal, and the Romberg test showed no significant findings. Cerebellar function tests were also normal. The results of his blood laboratory examination, including creatine kinase levels, were within normal limits. Another ophthalmologic consultation was requested, but no specific abnormalities were found. The patient underwent brain magnetic resonance imaging (MRI) with angiography and an electroencephalogram (EEG). The brain MRI with angiography did not show any abnormal findings (Fig. 1), nor was there any abnormality on the brain perfusion scan. However, digital EEG showed definite epileptiform discharges from the patient's left centrotemporal area, which was accentuated when he was asleep (Fig. 2).

We attributed the patient's visual symptoms to focal abnormal brain electrical activity, and he was prescribed the antiepileptic drug oxcarbazepine. After starting the antiepileptic drug, his symptoms improved. At present, our service is continuing to follow the patient, who no longer reports any visual symptoms.

**Discussion**

AWS is more common in children than adults. The classic symptom of AWS is a distorted body image, including altered perception of size and shape. However, children and adolescents younger than 15 years with AWS usually present with visual symptoms, including micropsia or teleopsia. Liu et al. reported that the most common visual symptom in patients with AWS is micropsia (69%) and that the incidence of pelopsia is 10%. Another study reported that the incidences of micropsia and pelopsia in cases of AWS were 6.5% and 4.1%, respectively. Other related symptoms, such as auditory hallucinations, are rare in patients with AWS (2%).

Liu et al. also reported that 15% of AWS patients have a history of
of migraine, 2% have a history of seizure, 46% have a family history of migraine, and 2% have a family history of AWS.

There are several etiologic theories of AWS, the most popular of which is migraine. Dooley et al. reported that 25% of migraine patients reported AWS symptoms during a long-term follow-up study. Interestingly, some cases of AWS appear to be due to drugs used to treat migraine such as topiramate. The second most frequently mentioned etiologic theory of AWS is infection, especially Epstein-Barr virus infection. One study found that AWS occurred in 15% of Epstein-Barr virus-infected patients. Epstein-Barr virus infection is known to cause focal brain parenchymal edema, which can lead to AWS. Finally, abnormal brain electrical activity, such as epilepsy, may also cause AWS. In all of these etiologic theories, the parietal lobe is believed to be the source of AWS; however, there is no still definitive etiology for this condition. One study of patients with AWS found regional cerebral blood flow abnormalities within the temporal and occipital lobes and within the perisylvian area; these areas are close to or directly include the visual pathway and the associated visual cortices.

There is no standard treatment for AWS, and most cases are considered benign. However, patients with AWS should be treated for any underlying condition, such as a migraine, encephalitis, or epilepsy.

In this case, the patient was found to have excitable discharges from a centrottemporal area that was relatively close to the visual pathway. Although the initial dose of oxcarbazepine was not effective, his symptoms improved after a dosage titration. Therefore, based on his response to treatment with an antiepileptic drug, we believe that his visual symptoms were associated with his EEG abnormality.

In conclusion, EEG and neuroimaging studies may be
warranted in children who present with uncommon visual symptoms with or without migraine or a family history of migraine.

요약

AWS는 감각스러움 자신의 실제 크기 혹은 모양이 다르게 보이는 증상을 특징으로 하는 증후군이지만, 어린 아이나 15세 이하의 청소년에서는 사물이 작게 보이거나 멀리 보이는 것과 같은 시각적 증상이 흔하게 관찰된다. AWS를 설명하기 위해 여러 가지 이론이 존재하며, 그 중 흔히 받아들이는 것은 편두통과 연관성을 갖는 것이다. 하지만 문헌상으로 단순 편두통뿐만 아니라 뇌파상의 이상이 발견되는 경우도 보고되고 있다. 본 논문은 편두통의 과거력은 없으나 시각적 이상 증상 및 뇌파 이상이 관찰된 환아를 소개하여 AWS를 보이는 환아에서 뇌파 등의 검사가 필요할 수 있음을 보고하고자 하였다.

References