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Association of Linear Sebaceous Nevus Syndrome and Unilateral Megalencephaly

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Summary: We report unilateral megalencephaly in a 14-year-old girl with linear sebaceous nevus syndrome. A review of the radiologic findings in this case and in previously reported cases suggests that the seizures and developmental delay in this neurocutaneous syndrome are related to the migration anomaly of unilateral megalencephaly.

Index terms: Megalencephaly; Pediatric neuroradiology; Migration anomalies

Linear sebaceous nevus syndrome was described in 1962 as a neurocutaneous condition characterized by linear sebaceous nevi, developmental delay, and seizures (1). More recently this syndrome has been included in the broader term epidermal nevus syndrome, which encompasses any type of epidermal nevus associated with congenital abnormalities of the central nervous system (CNS) and other organ systems (2, 3). CNS findings in this syndrome have been described in various case reports and reviews since 1962 (4–26).

We present the computed tomography (CT) and magnetic resonance (MR) findings in a patient with linear sebaceous nevus syndrome. Based on this case and a review of the literature, we believe the association with unilateral megalencephaly may be an important feature of this neurocutaneous syndrome.

Case Report

The patient was a 14-year-old girl who had been previously diagnosed with linear sebaceous nevus syndrome. She was referred for MR of the brain to evaluate the cause of medically intractable seizures. History was remarkable for seizures since birth, developmental delay, and chronic right-sided otitis media and mastoiditis. Head circumference was 55 cm (75th percentile). She had a tan, linear, waxy-appearing right forehead skin lesion, a hyperpigmented nevus on the right side of the neck, and moderate hemihypertrophy of the right side of the face. She had a right strabismus but no other focal neurologic findings.

Electroencephalography showed slowing of the background activity on the right with frequent epileptiform discharges from the right parietal, temporal, and occipital regions. These discharges spread at times into the left occipital and parasagittal regions but were never recorded independently from the left side of the head.

MR demonstrated enlargement of the right posterior temporal, parietal, and occipital lobes (Figs. 1 and 2). The posterior body, trigone, and occipital horn of the right lateral ventricle were also enlarged. Mild pachygyric changes in the posterior right cortex included shallow sulci, widened gyri, and thickening of the cortical ribbon. T2-weighted, 2800/30-100/.75 (TR/TE/excitations), images revealed increased signal intensity in the white matter of the enlarged lobes. The left hemisphere was normal except for some displacement by the enlarged posterior right hemisphere. Skull abnormalities included a widened diploic space on the right which was of increased signal intensity on T1-weighted (600/20/1) images and decreased signal intensity on T2-weighted images (Figs. 3 and 4).

CT showed similar findings of right hemispheric and ventricular enlargement with decreased attenuation in the white matter of the right hemisphere. The calvarium was asymmetric. The right frontal and temporal diploic spaces were widened, and there was thickening of the overlying soft tissues (Fig. 5). The thickened bone extended to the skull base, including the sphenoid wing and petrous bone. The right mastoid air cells were hypoplastic and showed evidence of previous mastoidectomy.

Discussion

The association of various types of epidermal nevi with other anomalies of the CNS or other organ systems constitutes the epidermal nevus syndrome. The linear sebaceous nevus syndrome has been more narrowly defined as the triad of linear sebaceous nevi, developmental delay, and

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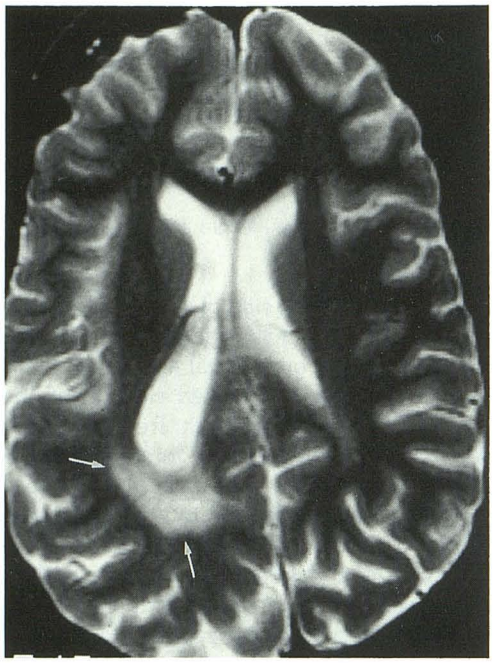

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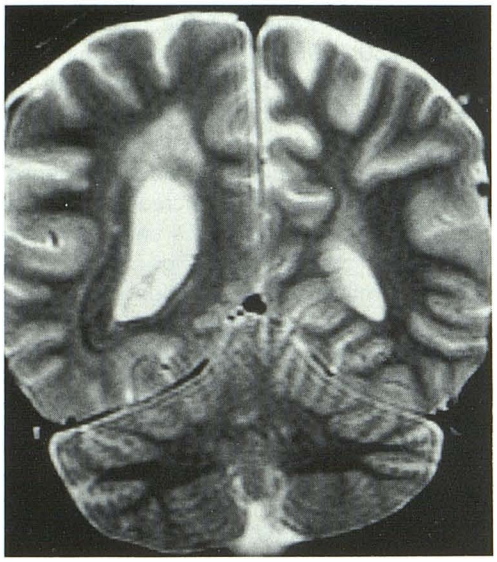

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Fig. 1. Axial T2-weighted (2800/100) MR image. Enlarged posterior right cerebral hemisphere and lateral ventricle, as well as abnormal white matter signal (*arrows*), are findings of unilateral megalencephaly.

Fig. 2. Coronal T2-weighted (2900–80) MR image through the level of the occipital horns. Findings of unilateral megalencephaly are again demonstrated, and broadened gyri and thickened cortex are present on the patient's right.

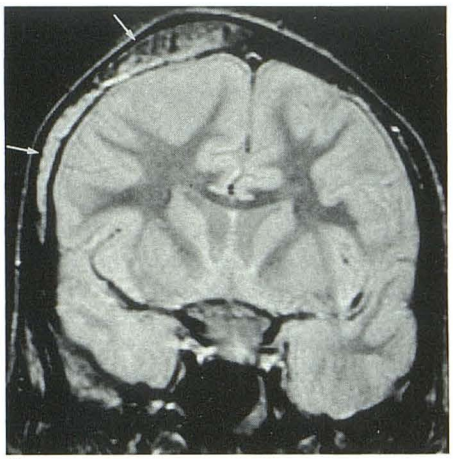
seizures. Both the nevi and the syndromes have been described under many different names and, therefore, may be more common than previously believed. Integrating the results of previous reports is made difficult by the inconsistent nomenclature for the syndromes (organoid nevus syndrome, Jadassohn nevus phakomatosis, nevus unius lateris, and others).

Linear sebaceous nevi are tan or yellowish linear nevi, often located at the midline. They are only one of several types of epidermal or organoid nevi. Epidermal nevi rise from the basal layer of the embryonic epidermis and are considered congenital hamartomatous malformations. These lesions are most often visible at birth but may appear during childhood. There is a high incidence of associated congenital abnormalities (33% in a recent series) (3). As many as 50% of these abnormalities may involve the CNS (2). The incidence of CNS abnormalities is most common in those patients with nevi on the head or face (20). Unilateral soft tissue or bony overgrowth is also seen. It has been suggested that all patients with these types of epidermal nevi deserve a careful evaluation to exclude associated abnormalities (3). Seizures and other neurologic abnormalities are likely to result in the neuroradiologic evaluation of many of these patients.

Unilateral megalencephaly (hemimegalencephaly) is the enlargement of all or part of one cerebral hemisphere. This rare brain malformation is though to be a result of abnormal neuronal migration (27). Radiographic features of unilateral megalencephaly were described in 1978 and in subsequent reports (27–30). These findings include: enlargement of all or part of one cerebral hemisphere; enlargement of the ipsilateral lateral ventricle; agyria or polymicrogyria (more common); and an increased volume of white matter with gliosis on the affected side. The opposite hemisphere is normal.

Clinically, patients with unilateral megalencephaly frequently have seizures and developmental delay (27, 30). The seizure disorders in these patients are often of early onset and become resistant to medical therapy. The epileptic focus is located in the enlarged hemisphere, and some patients have benefited from hemispherectomy (22, 31).

The MR and CT findings of unilateral hemisphere enlargement with ipsilateral ventriculomegaly and characteristic abnormalities of the white matter and cortex in our patient are typical of unilateral megalencephaly. The electroencephalogram abnormalities also were characteristic of this diagnosis. Skull abnormalities were ipsilateral to the abnormal hemisphere. On MR, a widened diploic space contained material with signal characteristics of fat. Asymmetry of the calvarium is a variable finding in unilateral megalencephaly



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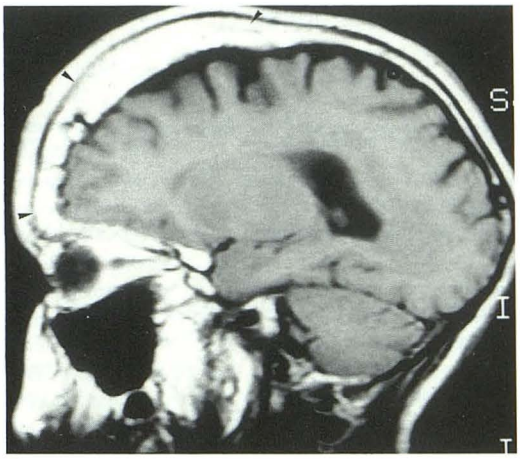

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Fig. 3. Coronal long TR, short TE (2900/30) spin-echo MR image through the level of the frontal horns. Cerebral hemispheres are nearly symmetric. Diploic space is thickened on the patient's right (*arrows*).

Fig. 4. Sagittal T1-weighted (600/20) MR image to the right of midline. Markedly thickened frontal diploic space (*arrowheads*) has signal characteristics similar to those of fat.

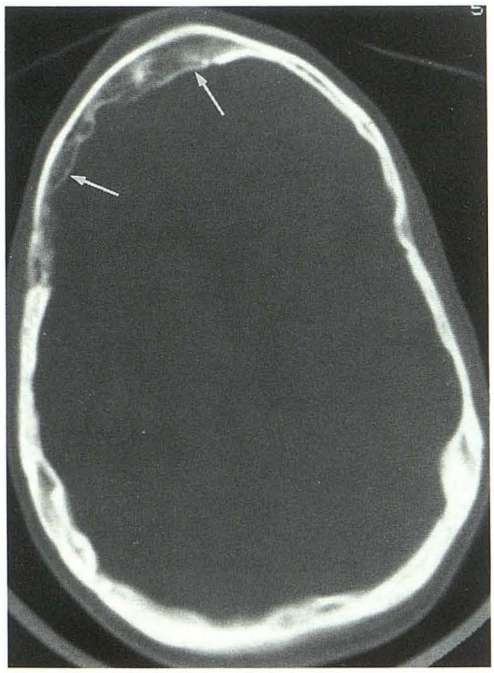

Fig. 5. Axial CT image, bone window. Frontal, right diploic space is thick and of low attenuation (*arrows*). Abnormal bone continued on the right down to the skull base.

(30). However, overgrowth of tissues is part of the spectrum of abnormalities seen in epidermal nevus syndrome and commonly involves bones of the skull and face and tissues such as fat and connective tissue (32). Our patient suffered from chronic otitis media and had several operations for mastoiditis. Inasmuch as all of these infections occurred on the right side, it may be that the skull overgrowth contributed to eustachian tube dysfunction.

Many early descriptions of the CNS findings in linear sebaceous nevus syndrome relied on such modalities as plain films, transillumination, pneumoencephalography, and angiography (4, 5, 10, 11). However, in retrospect, descriptions such as an enlarged hemicranium with ipsilateral ventricular enlargement in a number of cases suggest the possibility of unilateral megalencephaly (4, 10, 11). Unilateral "cerebral atrophy" was sometimes described in these early reports, and it seems quite possible that some of these cases were actually cases of unilateral megalencephaly.

Since 1978, CNS findings of linear sebaceous nevus syndrome by CT and MR have been described (12, 14–26). Of the 36 patients described in these articles (including our case), at least 26 have radiologic findings consistent with unilateral megalencephaly. The findings of unilateral megalencaphaly were not always identified as such. In several articles, an association between linear sebaceous nevus syndrome and unilateral megalencephaly was noted (18, 19, 22, 25).

Our review of the radiologic findings in the 26 case reports mentioned above revealed the following findings of unilateral megalencephaly: unilateral ventricular enlargement in 23, skull vault asymmetry in 19, unilateral hemisphere enlargement in 19, abnormal white matter demonstrated on either CT or MR scans in 13, and cortical anomalies in 9. Right and left hemispheres were equally represented (12, 15–19, 21–26). The consistent and frequent demonstration of these findings indicates that unilateral megalencephaly is a common finding in this syndrome.

Based on our review of the literature, and as illustrated by our case, we believe that the seizures and developmental delay seen in patients with linear sebaceous nevus syndrome (or epidermal nevus syndrome) may be the result of the

associated neuronal migration anomaly of unilateral megalencephaly.

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