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COMPUTERIZED TOMOGRAPHIC FINDINGS OF COMPLEX PARTIAL SEIZURES IN CHILDHOOD AND ADOLESCENCE*

*Banu Anlar MD***, Yavuz Renda MD****, Canan Erzen MD*****

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Complex partial seizures (CPS) constitute approximately 20% of the cases of childhood epilepsy and are most frequently seen between the ages of seven to eleven[1]. These types of seizures may have variable and peculiar symptomatology characterized by altered consciousness associated with semi-purposeful automatic motor acts like smacking of the lips, swallowing movements, grasping movements of the hands or inappropriate behaviour and may be preceded by an aura of anxiety. In addition to the various causes, infantile febrile convulsions have a particular role in the etiology of the subsequent CPS. Frequently, organic and structural lesions are investigated as the possible cause of these seizures. Since the advent of the computerized tomography (CT) technique, patients with epilepsy as well as other neurologic disorders could be subjected to detailed neuroradiologic studies. Although newer radiodiagnostic methods like nuclear magnetic resonance or positron emission tomography have been developed in recent years, their use at present is limited to a few centers. Therefore in epileptic patients, CT remains the diagnostic tool most frequently used after the EEG. Studies concentrated on the value of CT in childhood epilepsy are relatively rare. In this study the clinical, electroencephalographic and tomographic findings of a group of children and adolescents with CPS are evaluated.

* From the Department of Pediatrics, Hacettepe University Institute of Child Health, Ankara.
** Pediatrician, Hacettepe University Institute of Child Health.
*** Professor of Pediatrics, Hacettepe University Faculty of Medicine.
**** Associate Professor of Pediatrics, Hacettepe University Faculty of Medicine.

Material and Methods

The study group consisted of 40 patients aged between 5-22 years seen at Hacettepe University Children's Hospital between the years 1983-1987 and having at least a one-year follow-up. There were 21 boys and 19 girls. Their ages at seizure onset varied between 5 months and 20 years.

The diagnosis of CPS was based on the description of the seizure type in 36 patients. In the remaining four, the clinical characteristics of the seizure were less indicative but the EEG revealed a primary temporal focus. From the history and neurologic examination, a definite cause was found in ten cases: perinatal cerebral injury (two cases), depressed skull fracture (two cases), blunt head trauma (two cases), subdural hematoma due to hemophilia (one case), tuberous sclerosis (two cases), and neurofibromatosis (one case). In two patients, a history of infantile febrile convulsions was present and was considered to be a probable cause. The remaining 28 formed the group of patients whose seizures were of unknown etiology.

The patients were separated into two groups according to type of seizure: those with generalized convulsions of temporal onset (n = 7) and those with only partial seizures (n = 33).

An 8-channel EEG using mono- and bi-polar recordings with an international 10-20 electrode placement was obtained for every patient at the first examination. No sedatives, provocative methods or special electrodes were used for this first EEG. The findings were classified as follows:

1) Unilateral temporal focus (n = 17)

2) Diffuse epileptic activity with temporal predominance (n = 5)

3) Normal EEG or mild disturbances of background bioelectric activity (n = 18).

The patients were also divided into three groups according to the response of the seizures to therapy: good response (no seizures or 1-2 per year; n = 9), moderate response (1-2 seizures per month; n = 7), and poor response (more frequent than once a week; n = 20).

The CT studies were performed with a Tomoscan 350 scanner. Children younger than seven years of age were sedated with oral triclorethylphosphate. In this age group, slices of 6 mm thickness were obtained from the level of the foramen magnum up to the vertex. The slice thickness was 9 mm in older children. Non-contrast and contrast studies (with Urovision 1 ml/kg i.v.) were done in each case. When arachnoid cysts were suspected, 10 ml of iohexol (Omnipaque) was injected intrathecally for their diagnosis. Fisher's exact X^2 test was used for statistical analysis.

Results

The CT findings were grouped as follows:

1) Diffuse cerebral atrophy (two patients),
2) Local atrophy (17 patients); among these cases there were seven with unilateral atrophy, five with bilateral enlargement of Sylvian fissures and five with atrophy and porencephaly in one hemisphere. The critera for atrophy are listed in Table I.

TABLE I: Criteria for Atrophy on CT

1) **Sylvian fissures:**
   Asymmetric enlargement
   Bilateral enlargement of 8 mm or more
2) **Temporal lobes:**
   Sulcus width of more than 4 mm
   Asymmetry in the number of temporal sulci
3) **Frontal lobes:**
   More than three sulci in one hemisphere
   Sulci wider than 4 mm
4) **Anterior interhemispheric fissure:**
   Larger than 10 mm

3) Space-occupying lesions (two patients). One patient had an arachnoid cyst and the other, a hypodense lesion in the base of the right temporal lobe, which was suspected to be a cystic astrocytoma. A biopsy from this area showed glial proliferation. This patient is being followed up with the possible diagnosis of astrocytoma.
4) Subependymal calcifications (two patients),
5) Diffuse cerebral edema (one patient),
6) Other findings: megalencephaly and craniosynostosis (one case each),
7) Normal CT (14 patients).

Atrophic changes were the most frequent pathologic CT findings (47.5%) followed by normal scans (35%)

The CT findings (normal and abnormal) were examined in relation to the type of seizure, the EEG findings and the response to therapy. These results are shown in Tables II, III, and IV, respectively.

The proportion of abnormal CT results was not significantly different from the groups with partial or generalized seizures ($p > 0.05$, Table II).

The ratio of abnormal CTs was 94% in patients with unilateral focus on EEG, while it was about 40% in patients with other EEG findings ($p < 0.05$, Table III).

The relation between seizure control and CT abnormalities was not significant; 75% of the patients with refractory seizures had abnormal CTs while this percentage was 56 and 43 in the other groups ($p > 0.05$, Table IV).

TABLE II: CT Findings and Seizure Type

	Normal CT		Abnormal CT	
Seizure	n		n	
Partial only	12	(36%)	21	(64%)
Partial and generalized	2	(29%)	5	(71%)

TABLE III: EEG Localization and CT Findings

	Normal CT		Abnormal CT	
EEG Abnormality	n		n	
Unilateral temporal focus*	1	(6%)	16	(94%)
Diffuse abnormal+ temporal dominance	3	(60%)	2	(40%)
Other	10	(56%)	8	(44%)

* $p < 0.05$ when compared to the other two groups.

TABLE IV: Seizure Control and CT Findings*

	Normal CT		Abnormal CT	
Seizure control	n		n	
Good	4	(44%)	5	(56%)
Moderate	4	(57%)	3	(43%)
Poor	5	(25%)	15	(75%)

* $p > 0.05$ (the first two groups were combined for statistical analysis).

Discussion

Computerized transaxial tomography is extensively used in the diagnostic evaluation of epilepsies. Consequently, the proportion of organic lesions diagnosed in epileptic patients has increased from 30% to 46% after the use of CT[2,3]. An important part of these abnormalities consists of atrophic changes. When partial seizures are evaluated separately, the incidence of CT abnormalities are found to be higher. In 84 patients with psychomotor epilepsy, Gastaut and Gastaut[2] reported focal lesions in 36%, and diffuse lesions in 24% of the patients. Only 40% of the patients' CTs were normal. Tumors were found in 16% of the patients older than 20 years of age. Other authors have obtained similar results[4]. The etiology, and as a result the incidence and nature of the organic lesions observed with CT differ in adults and children. Perinatal ischemic and developmental lesions are expected to be higher in children while neoplasms and vascular obstructions are less frequent. Relatively few studies have been conducted only on children. Patel et al[5] found 20% of CT abnormalities such as atrophies, infarcts, porencephalic cysts, in order of frequency, in 115 children with all types of convulsions. In our study, which was devoted to partial seizures, we obtained similar results; the most frequent pathologic changes were local atrophies. Unlike the adult patients, the incidence of space-occupying lesions was low. The two patients with calcifications on CT had tuberous sclerosis diagnosed clinically. The incidence of CT abnormalities was higher among the patients with a definite or suspected etiology. Of 12 such patients, only two had normal scans; a patient with multiple cafe-au-lait spots and another with a history of head trauma.

In our study, there was no relationship seen between the type of seizure i.e., the seizure being generalized or only partial and the proportion of abnormalities on CT (Table II). Ishida et al[6], whose results were similar, reported that positive CT findings were found almost equally in secondary generalized epilepsy and partial epilepsy.

In our findings, the ratio of abnormal CT results was higher in patients with unilateral discharges on EEG (Table III). The CT abnormality was on the same side with the EEG abnormality in 10/16 cases. This result reflects the statement made by some authors that structural changes on CT may not always correlate with clinical, electroencephalographic and pathologic identification of epileptogenic foci[7]. In patients with more diffuse EEG abnormalities or a normal EEG, there seems to be about the same probability for normal or abnormal CT scans.

It has been stated that most patients with refractory CPS have structural lesions in one temporal lobe[8,9]. In our study, CT was normal in five out of the 19 patients with refractory seizures (Table IV); a focal abnormality was present in eight of them. CT may have failed to show small lesions or some diffuse lesions may have caused partial attacks because of the low convulsive threshold of temporal structures. As suggested by some authors, CT with subarachnoid metrizamide injection may demonstrate mesial temporal herniation and may be useful in patients with refractory CPS who are candidates for surgery.

Our results suggest that CT is a useful method in the evaluation of childhood CPS. In 65% of our cases, the CT findings were found to be abnormal. The proportion of abnormal CT's is higher when the seizures have an established cause, when unilateral temporal discharges on EEG are present, and when the seizures are refractory. Since surgical therapy may be considered in partial seizures not responding to anticonvulsant medication, a CT is particularly indicated in such cases.

Summary

The CT findings of forty children and adolescents with complex partial seizures were evaluated in relation to the type of seizure, the EEG pattern and the response to therapy. The rate of CT abnormalities was 65%, the majority being atrophic changes. The patients who had unilateral temporal discharges on EEG, a definite or suspected cause for epilepsy, or refractory seizures were more likely to have abnormal scans. We believe that a CT is particularly indicated in these patient groups.

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