Computed tomographic findings in childhood hemiplegia

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Childhood hemiplegias have been divided into two groups: congenital and acquired. The former group has also been referred to as the hemiplegic form of cerebral palsy. Either may have multiple etiologies.[1] In 1933, Dyke et al[2] described abnormalities in the skull roentgenograms of children with childhood hemiplegia. We have reviewed the computed tomographic (CT) scans in 54 patients with childhood hemiplegia and report the abnormalities found.

Case material

Fifty-four hemiplegic patients were studied retrospectively. Patients with severe bilateral involvement, brain tumors, progressive neurologic disorders, neurocutaneous syndromes, and hemiplegia of recent onset were excluded. The records of these excluded patients were reviewed.

All patients were interviewed and information concerning pregnancy, labor and delivery, birth weight, seizures, mental development, and possible etiologic factors was obtained. Pediatric and neurologic examinations followed. Results of psychometric testing, electroencephalograms (EEGs), skull roentgenograms, and contrast studies were reviewed.

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CT scans without enhancement were obtained using the EMI scanner in 45 cases and the Delta Ohio Nuclear Scanner in nine cases. Sedation techniques varied and scans showing movement artifacts were excluded. CT scanning has been useful in defining intracranial structural abnormality.[3]

Results

Thirty-four patients had congenital hemiplegia and 20 had the acquired form. The male to female ratio in both groups was similar. The average age of onset in the acquired group was 3 years and the average age at examination in both groups was 8 years. Prenatal and perinatal abnormalities were more frequent as expected in the congenital group. The right side was more frequently affected in both groups. Hemiatrophy, seizures, mental retardation, and abnormal EEGs were frequently present in both groups. The statistical frequency of these associated problems does not differ significantly from other reported patients with both forms of childhood hemiplegia[1] (*Table*).

Pneumoencephalography had been performed on four patients, two from each category. All showed unilateral ventricular enlargement and ipsilateral shift. Six angiograms had been performed on the congenital group. Three showed unilateral atrophy; two, vascular occlusions; and one, the changes seen in the Wyburn-Mason syndrome. Eight angiograms had been performed in the acquired group: three were normal; two had diffuse vasculitis; one, the changes consistent with atrophy; one, a complete carotid occlusion; and one, a subdural hematoma.

The causes in the acquired group included trauma in six, an infectious process or elevated fever in five, and cardiac abnormalities in three. No cause could be found in six cases. The etiologies were compared with those in the Dyke series and were not dissimilar.

Skull roentgenograms in most of the patients were reported to be normal. A sampling of these roentgenograms was obtained and reviewed, and changes consistent with those described by Dyke and referred to as the DDM skull were found in many.

CT findings in most patients conformed to one of two patterns. The first pattern revealed unilateral ventricular enlargement and ipsilateral shift, i.e., a shift of the cerebral content toward the affected side (*Fig. 1*). The second pattern was consistent with infarct, i.e., an area of decreased density (*Fig. 2*). A few scans showed a mixed pattern, but one pattern could usually be described as

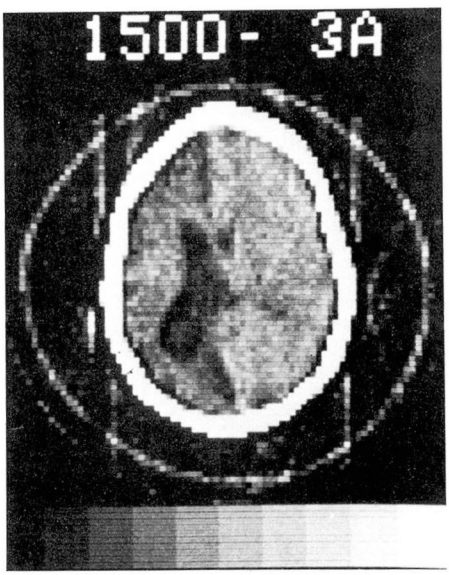

Fig. 1. Unilateral ventricular enlargement with ipsilateral shift.

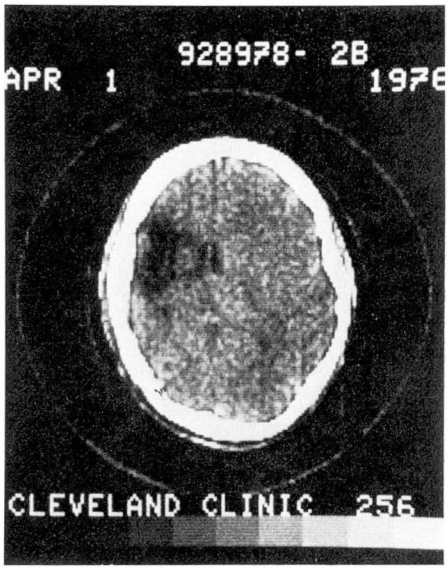

Fig. 2. Infarct pattern.

the dominant one (*Fig. 3*).

In the congenital group, the patterns were equally divided. In the acquired group, the infarct pattern was more frequent, especially in the so-called post-traumatic group (*Table*). No pattern was of a specific etiology.

Case reports

Case 1. A child with congenital hemiplegia had difficulties at birth during labor and delivery. Birth weight was 2 kg. Developmental retardation and seizures were noted in the first year of life. Physical examination showed left hemiplegia. The CT scan revealed unilateral ventricular enlargement and ipsilateral shift pattern (*Fig. 1*).

Case 2. This patient had congenital hemiplegia. Pregnancy was abnormal and labor and delivery were prolonged. Seizures and developmental retardation were noted within the first year of life. Physical examination revealed microcephaly, right hemiatrophy, and right hemiplegia. The CT scan revealed an infarct pattern (*Fig. 2*).

Case 3. Acquired hemiplegia developed acutely at 3 years and vascular occlusion was demonstrated by angiography. Mental retardation and seizures followed. Physical examination revealed right hemiplegia. CT findings were those of ventricular enlargement and ipsilateral shift (*Fig. 1*).

Case 4. This patient has acquired hemiplegia. An atrioseptostomy was per-

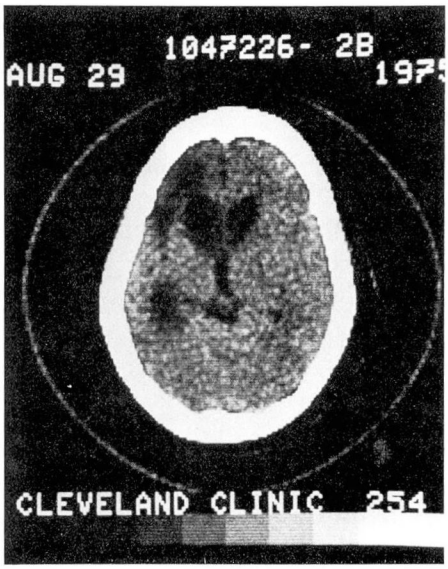

Fig. 3. Combined pattern; unilateral ventricular enlargement and infarct.

Table. Childhood hemiplegia; CT findings

	Congenital (34)	Acquired (20)
Unilateral ventricular enlargement with ipsilateral shift	14	5
"Infarct"	16	14
Calcification	2	0
Mixed	4	1
Seizures	21/34	16/20
EEG abnormalities	30/31	17/19
Mental retardation	16/31	9/15
Angiographic abnormalities	6/6	5/8
Pneumoencephalographic abnormalities	2/2	2/2

formed at age 3 years for cyanotic congenital heart disease, and seizures developed as a complication of catheterization. Delayed development followed. Physical examination revealed a right hemiparesis. CT scan showed a pattern consistent with infarct (*Fig. 2*).

Case 5. Coma at 2½ years of age was caused by encephalitis. Mental retardation, seizures, and hemiplegia were sequelae of that illness. Physical examination revealed right hemiatrophy and right hemiplegia. CT scan revealed a combination of both infarct and unilateral ventricular enlargement with ipsilateral shift (*Fig. 3*).

Among the patients excluded from the study, six had abnormal neurologic findings bilaterally and despite this showed the pattern of unilateral ventricular enlargement and ipsilateral shift. Two patients with definite unilateral hemiplegia had normal CT scans. Three patients with other nonfocal neurologic problems and normal neurologic examinations unexpectedly showed unilateral ventricular enlargement and ipsilateral shift.

Discussion

Dyke et al[2] described abnormalities in the skull roentgenograms of nine patients with infantile hemiplegia: five had acquired hemiplegia, and four had congenital hemiplegia. The clinical characteristics of their patients were similar to those we have described. All patients had thickening of the cranial vault, overdevelopment of the frontal and ethmoid sinuses, and overdevelopment of the air cells of the petrous pyramid of the temporal bone on the side of the cerebral lesion. The midline was shifted toward the side of the cerebral lesion. Pneumoencephalograms revealed enlargement of the lateral ventricle on the side of the cerebral lesion and displacement of the ventricle toward the affected side. Dyke et al postulated that the thickened bone, enlarged sinuses, and dilated ventricles were attempting to compensate for the unilateral loss of cerebral substance. They concluded that when the described roentgenographic changes were present, the diagnosis of localized cerebral hypoplasia could be made with certainty.

The CT findings of unilateral ventricular enlargement and ipsilateral shift shown by CT occurred more frequently in cases of arterial vascular disease. Angiograms were normal in some cases despite this suspicion. This pattern is also observed in trauma and in other cases where nonvascular etiologies have been proved.

The infarct pattern can be due to many factors including head trauma, vasculitis, encephalitis, and meningitis. The final common pathway seems to be tissue necrosis in a vascular distribution.

Our study demonstrates that either pattern of CT abnormality, i.e., unilateral ventricular enlargement with ipsilateral shift, the infarct pattern, or the mixed pattern may be present in any given case of acquired or congenital childhood hemiplegia. Prospective studies of patients with both varieties of childhood hemiplegia in which etiologic factors, physical examinations, angiography and pneumoencephalography, skull roentgenograms, and CT scans are correlated with neuropathologic findings are not available. It is therefore impossible to be specific concerning the etiology or pathogenesis of any given CT abnormality. Most children with congenital or acquired hemiplegia will have one of these patterns. It is uncommon to find the abnormality without finding the coexisting hemiplegia.

Summary

The CT findings in 54 patients with childhood hemiplegia are described. Three patterns are noted: unilateral ventricular enlargement and ipsilateral shift, a pattern consistent with infarct, and a mixed pattern. None of these patterns was specific with regard to etiology. A few patients with bilaterally abnormal neurologic examinations will show unilateral CT abnormality, a few patients with definite hemiplegia will show normal CT scans, and rarely patients with normal neurologic examinations may show unilateral CT abnormalities.

References

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