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TUBERCULOUS MENINGITIS IN CHILDHOOD: CLINICAL AND COMPUTERIZED TOMOGRAPHY SCAN MANIFESTATIONS*

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Tuberculous meningitis is a major problem in pediatric practice in some countries. In spite of the availability of newer chemotherapeutic agents, it still carries high mortality and morbidity. Mortality rates range from 17% to 71.9%[1]. The ultimate diagnosis of this disease rests on characteristic CSF (cerebrospinal fluid) changes and observation of the organism on acid-fast stain or culture of the CSF, which usually requires three to six weeks. Radioisotope brain scan, cerebral angiography and pneumoencephalography are helpful, but often fail to visualize with clarity the pathologic process in the meninges[2,3].

Reports on computerized tomography (CT) findings of childhood tuberculous meningitis are few[4-7]. We studied 12 cases of tuberculous meningitis using the CT scan in addition to common diagnostic techniques. The clinical and CT findings are presented in this paper.

Material and Methods

Twelve cases of childhood tuberculous meningitis were included in this study. All the patients were given a complete physical and neurologic examination. Chest and cranial X-rays, EEG, tuberculin skin test, CSF examination and cultures were obtained. CT scans were performed at the time of admission and at two-month intervals. All the patients were given isoniazid, streptomycin, rifampicin and corticosteroids.

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TABLE I: Clinical and Laboratory Findings of Patients with Tuberculous Meningitis

Case No.	Age (yrs)	Sex	Family history	Presentation	Neurologic findings	Purified protein derivative test	Chest radiography	Cerebrospinal Fluid findings			Blood sugar (mg/dl)
								Cell (mm^3)	Protein (mg/dl)	Sugar (mg/dl)	
1	12	M	Sister Brother	Stupor Stiff neck	Right Optic atrophy	Positive	Hilar adenopathy	60	280	33	5
2	13/12	F	–	Drowsiness Generalized seizures	Right facial palsy	Positive	Hilar adenopathy	10	122	54	9
3	9	F	Father	Headache Drowsiness Stiff neck	Right hemiparesis	Positive	Hilar adenopathy and calcification	130	120	55	8
4	18/12	M	–	Seizures	Bilateral optic atrophy	Negative	Normal	70	440	50	12
5	5	M	–	Seizures	Decerebrate rigidity	Negative	Miliary infiltration	20	103	21	12
6	14	M	–	Stiff neck	Left oculomotor, right facial palsy right hemiparesis	Negative	Normal	120	210	41	13
7	1	M	Father Mother	Focal seizures Stiff neck	Bilateral optic atrophy	Positive	Hilar adenopathy	210	220	70	10
8	8	M	–	Headache Stiff neck	Right hemiparesis	Positive	Primary focus	80	165	17	11
9	4/12	F	Father	Generalized seizures	Right hemiparesis	Negative	Normal	100	87	38	9
10	11	F	Grandmother	Headache Stiff neck	Right abducens palsy	Positive	Normal	80	120	35	8
11	2	M	–	Generalized seizures	Decerebrate rigidity	Positive	Normal	70	250	15	6
12	5	M	Sister Brother	Stiff neck	Left facial palsy	Negative	Primary focus	190	180	37	10

TABLE II: CT Scan of Patients with Intracranial Tuberculosis

	Initial Findings							
	Precontrast					Postcontrast		Follow-up findings
Case No.	Calcification	Hydrocephalus	Infarct	Basal cisterns	Mass	Nodular enhancement	Basal cistern enhancement	
1	+	+	–	Enlarged	Multiple	+	–	No improvement
2	–	+	+	Deformed	Multiple	+	–	–
3	–	+	–	Obliterated	–	–	+	Decrease of hydrocephalus reduction of basal exudate
4	–	+	–	Obliterated	–	–	+	Some improvement
5	–	+	+	Obliterated	–	–	+	–
6	–	+	+	Normal	–	–	–	Some improvement
7	–	–	+	Normal	–	–	–	–
8	–	+	+	Normal	–	–	–	Some improvement
9	–	–	–	Normal	–	–	–	–
10	–	+	–	Obliterated	–	–	+	Decrease of basal exudate, increase of hydrocephalus
11	–	+	–	Obliterated	–	–	+	Decrease of basal exudate, increase of hydrocephalus
12	–	+	–	–	–	–	–	Died

Results

The ages of the patients ranged between four months and fourteen years. A history of exposure to infected individuals was positive in six patients and the tuberculin skin test was negative in five. Chest x-ray showed some type of pathology with the exception of five cases. Only one patient's culture was positive for acid-fast bacilli. A summary of the data of the patients is given in Table I.

We were able to obtain a follow-up CT from only seven patients, one patient died on the tenth of admission and in four patients; the families were unable to afford the expense of follow-up scans. CT findings at the time of admission and at two months follow-up are summarized in Table II.

Discussion

In tuberculous meningitis, diagnosis is still a problem. History and laboratory tests are often nonspecific and rarely pathognomonic[8]. In two-thirds of the patients there is a history of early tuberculosis or exposure to infected individuals[9]. In our study, six patients had a family history of the disease but no report of earlier tuerculosis. The tuberculin skin test was positive in 58.33% of the patients which complies with the literature[9].

It has been reported that some type of pulmonary infiltrate is seen on one third of the chest x-rays, however this rate was higher in our study[8,10,11]. In our study group 33.3% of the cases had hilar adenopathy. One patient had both hilar adenopathy and calcification, one showed evidence of miliary tuberculosis and two showed primary focus on the chest x-rays.. The remainder of the patients (five cases) had normal chest x-rays. The CSF findings of our subjects were consistent with other studies[11,12].

In our study hydrocephalus was the most frequently seen pathologic finding on the CT scans obtained at the time of admission. Of the twelve patients, ten had hydrocephalus, seven being of the communicating type.

These findings comply with previous studies. It has been reported that the most common CT abnormality is hydrocephalus, seen in greater severity in children than in adults. It is usually the communicating type, due to obstruction at the basal cisterns[8]. 58.33% of our cases showed cisternal abnormality which is the second most commonly reported lesion[5,8]. In most of the cases that demonstrated cisternal abnormality, the basal cisterns were obliterated (Fig. 1). In one case they were enlarged and in another deformed. Abnormal contrast enhancement of the basal cisterns were observed in five patients. Bhargava and Tandon[13] concluded that enhancement of the exudates and enlargement of the cisterns were seen in

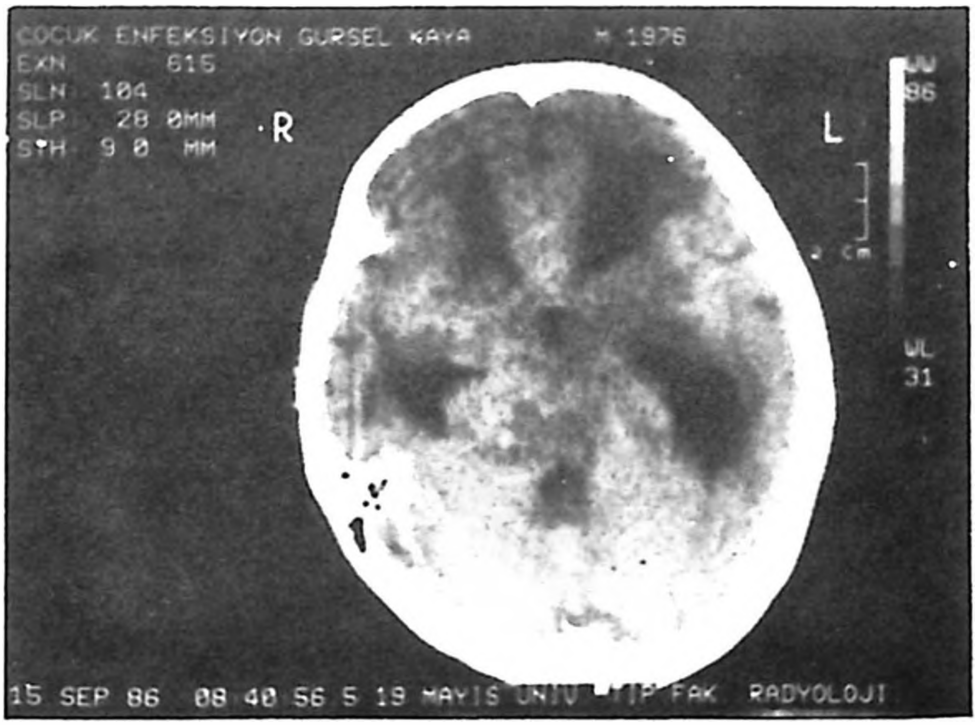

Fig. 1: Precontrast CT study of Case No. 3 shows marked dilatation of the ventricular system and obliterated basal cisterns.

more advanced cases and this severe form occurred exclusively in children (Fig 2). Two of the patients in our series who presented with this type of abnormality on CT were also severe cases.

Multiple tuberculomas were present in the scans of two of our patients. It has been reported that small lesions can only be seen with contrast enhancement[14]. Similarly we were able to demonstrate only large tuberculomas in precontrast studies (Fig. 3). Punctate calcifications were observed in one of the patients (Case No. 1) who had multiple tuberculomas (Fig. 4).

Previous studies have stated that in less than one third of the patients with abnormal CT scans, infarcts are evidenced and that the territory of the middle cerebral artery is most often affected[13,15]. In our series five patients showed infarction of which two had multiple and the rest single infarcts in the region of the parietal lobe (Fig. 5).

We were able to obtain follow-up scans in seven of our patients. Case No. 1, who had multiple tuberculomas showed no improvement in CT findings after two months of treatment. There was a decrease in the degree of hydrocephalus and reduction of the basal exudate in Case No. 3 (Fig. 6). A follow-up CT of Case Nos. 4, 6 and 8 showed some improvement of hydrocephalus. Two patients had a decrease in basal exudate but an increase in hydrocephalus.

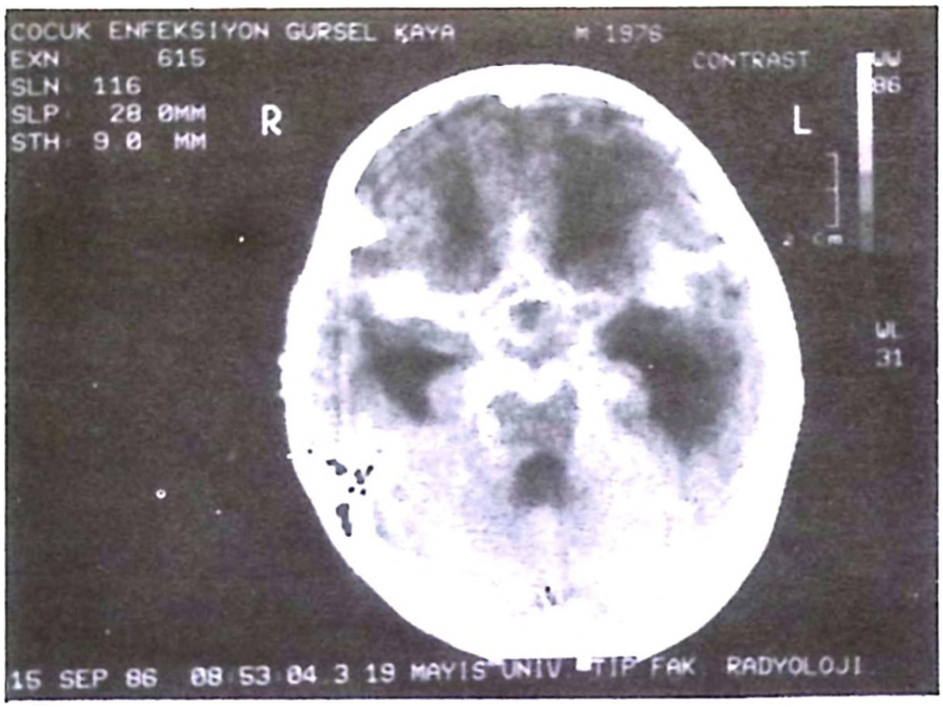

Fig. 2: Postcontrast CT study of Case No. 3 at the same level with Fig. 1 demonstrates abnormal enhancement in cisterns around the brainstem and the base of the brain.

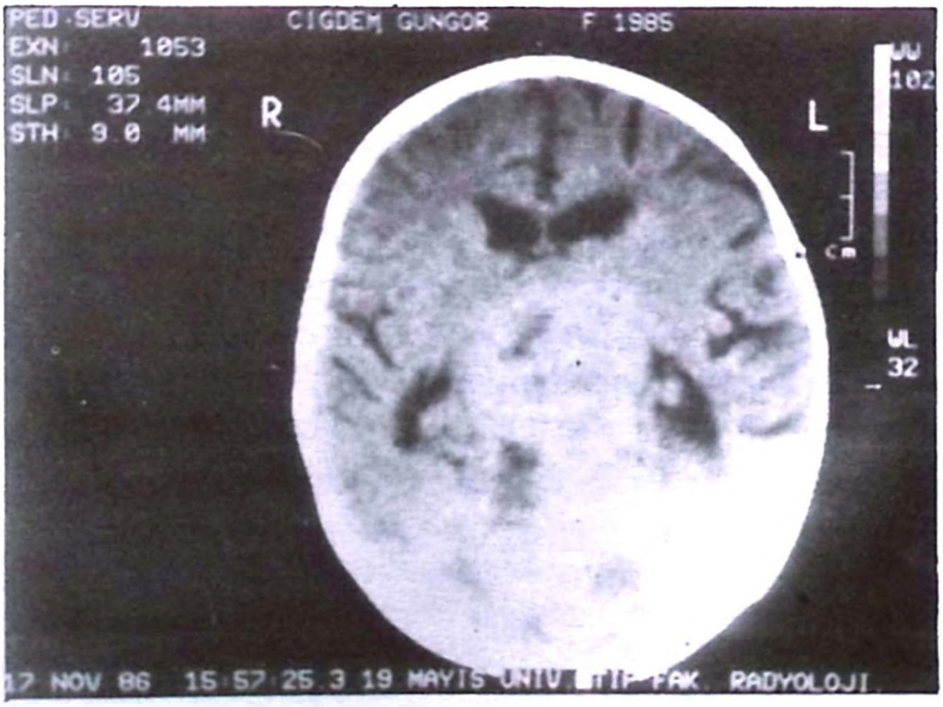

Fig. 3: Precontrast CT study of Case No. 2 shows a conglomerate mass at the level of the tentorial hiatus extending to the cerebral convexity along the midline.

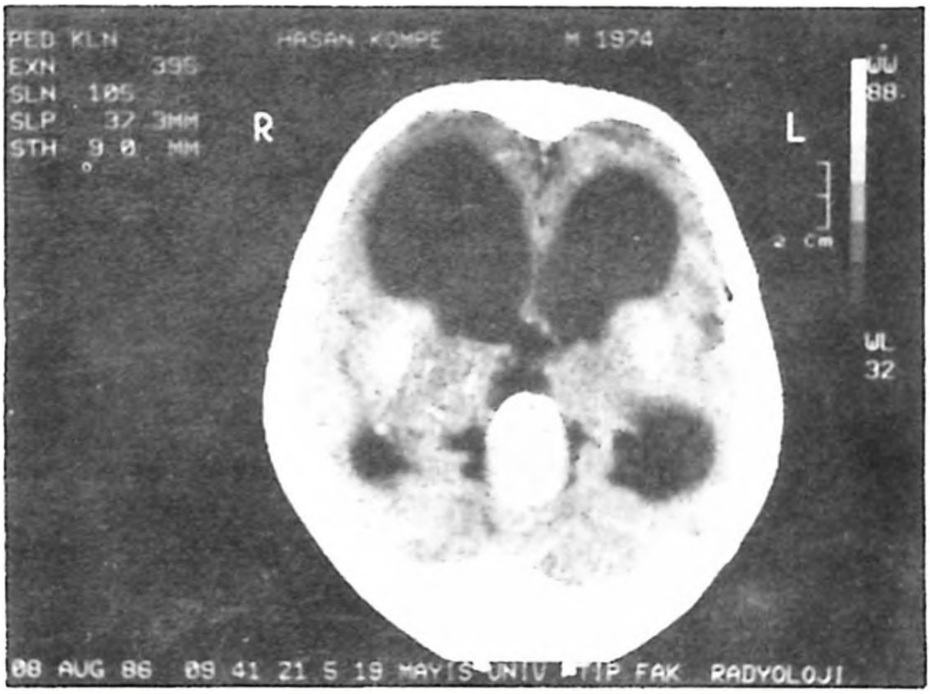

Fig. 4: Precontrast CT study of Case No. 1 shows marked dilatation of the third and lateral ventricles with a disc-shaped lesion just below the third ventricle with punctate calcification on its sharply outlined surface.

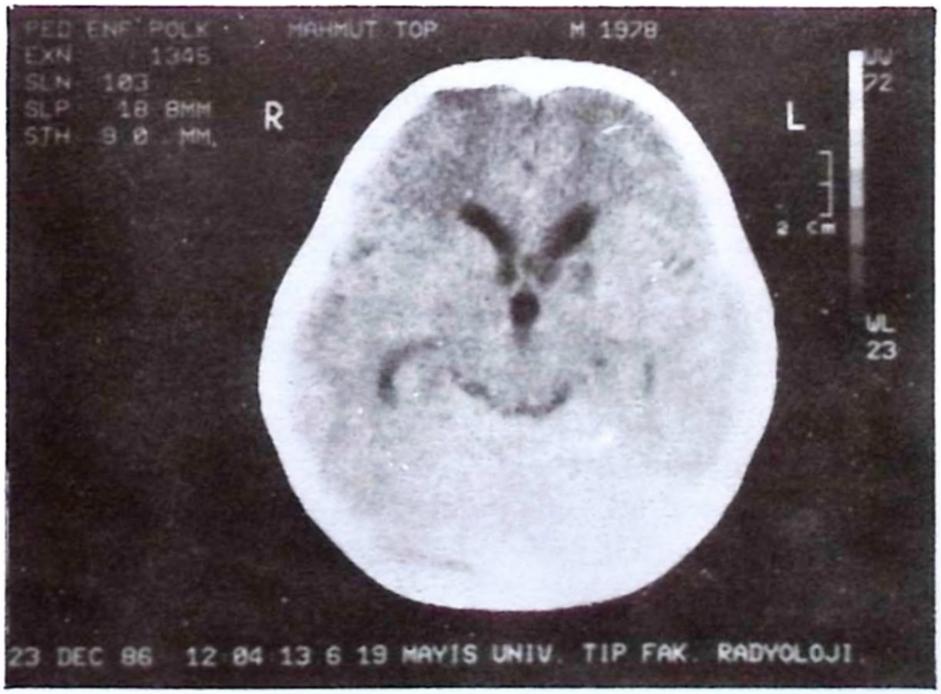

Fig. 5: Precontrast CT study of Case No. 8 shows a hypodense area (infarction) in the anterior part of the capsula interna on the left side.

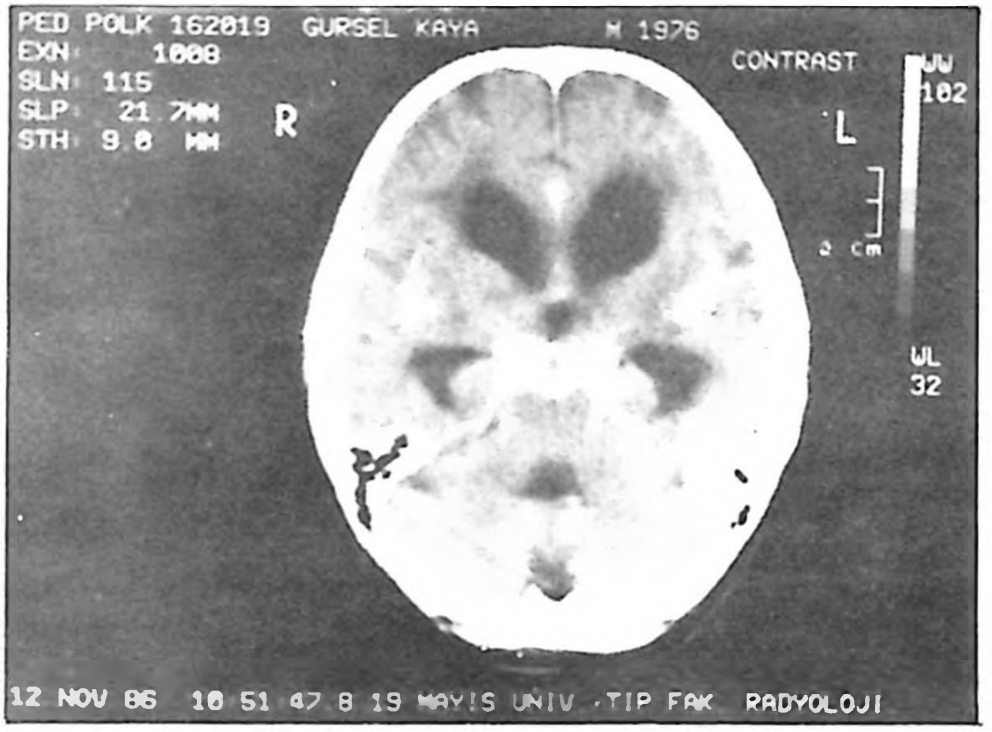

Fig. 6: Follow-up postcontrast CT study of Case No. 3 shows a decrease in hydrocephalus. Basal exudates have also been reduced.

Despite the marked decrease in the prevalence of tuberculosis in recent years, it is still endemic in some countries and the diagnosis continues to be a problem for the clinician. The advent of CT has contributed greatly to the early detection of intracranial abnormalities associated with tuberculosis. The use of CT in addition to other commonly used diagnostic and follow-up studies can increase the diagnostic accuracy and provide a convenient means of monitoring treatment response in tuberculous meningitis.

Summary

Twelve cases with tuberculous meningitis were studied by the use of computerized tomography. The clinical and CT findings are presented and discussed. The conclusion was reached that CT should be included in diagnostic and follow-up studies of tuberculous meningitis.

REFERENCES

1. Gourie-Devi M. Tuberculous meningitis in children: diagnosis and treatment. *Indian J Pediatr* 48:239, 1981.
2. Lehrer H. The angiographic triad in tuberculous meningitis. A radiographic and clinicopathologic correlation. *Radiology* 87:829, 1966.
3. Maroon JC, Jones R, Mishkin FS. Tuberculous meningitis diagnosed by brain scan. *Radiology* 104:333, 1972.
4. Arimitsu T, Jabbari B, Buckler RE, Di Chiro G. Computed tomography in a verified case of tuberculous meningitis. *Neurology* (Minneap) 29:384, 1979.
5. Chu N. Tuberculous meningitis. Computerized tomographic manifestations. *Arch Neurol* 37:458, 1980.
6. Marandian MH, Saboury-Deilami M, Haddadian K, Lessani M. Tuberculome intracérébral chez un enfant de deux ans. Intérét diagnostique de la tomodensitométrie. *Ann Pediatr* (Paris) 30:117, 1983 (Eng Abstr).
7. Mocquard Y, Chevalier F, Borsotti JP, et al. Tuberculomes multiples intra-cérébraux. Diagnostic et contrôles tomodensitométriques de l'evolution: un cas. *Ann Med Interne* (Paris) 136:405, 1985 (Eng Abstr).
8. Witrak BJ, Ellis GT. Intracranial tuberculosis: manifestations on computerized tomography. *South Med J* 78:386, 1985.
9. DeAngelis LM. Intracranial tuberculoma: case report and review of the literature. *Neurology* (NY) 31:1133, 1981.
10. Naughten E, Weindling AM, Newton R, Bower BD. Tuberculous meningitis in children. Recent experience in two English centres. *Lancet* 2:973, 1981.
11. Clark WC, Metcalf JC Jr, Muhlbauer MS, et al. Mycobacterium tuberculosis meningitis: a report of twelve cases and a literature review. *Neurosurgery* 18:604, 1986.
12. Kennedy DH, Fallon RJ. Tuberculous meningitis. *JAMA* 241:264, 1979.
13. Bhargava S, Tandon PN. Intracranial tuberculomas: a CT study. *Br J Radiol* 53:935, 1980.
14. Whelan MA, Stern J. Intracranial tuberculoma. *Radiology* 138:75, 1981.
15. Trautmann M, Kluge W, Otto HS, Loddenkemper R. Computed tomography in CNS tuberculosis. *Eur Neurol* 25:91, 1986.