Original Article

Cranial Computed Tomography in Childhood Bacterial Meningitis

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ABSTRACT

Objective: To evaluate the value of performing cranial Computed Tomography (CT) in the management of children with bacterial meningitis.

Setting: Pediatrics Departments, Al-Adan Hospital and Al-Farwania Hospital, Kuwait.

Subject/Method: A retrospective study of all patients with childhood bacterial meningitis who underwent computed tomography during a period from 1992-2000.

Result: Over an eight-year period, 60 children with bacterial meningitis underwent cranial computed tomography (CT). The most frequent indications for ordering the scans were seizures and neurological deficit in 37 patients (62%), prolonged and secondary fever in 18 patients (30%), changes in sensorium in 12 patients (20%), head trauma in four patients (7%) and recurrent meningitis in two patients (3%). The CT scan was abnormal in 37 patients (62%). The most common findings were subdural collection (19 patients; 32%), brain atrophy (8 patients; 13%) and hydrocephalus (6 patients; 10%). Less frequent abnormalities were skull fractures in two patients as well as brain edema and Cripriform encephalocele in one patient each. Neurosurgical intervention followed the procedure in five patients. The CT abnormalities were more frequently encountered in children with residual neurologic sequelae.

While the routine use of CT should be discouraged due to expense and radiation exposure, its selective use in children with a complicated course helps early neurosurgical intervention and probably prognostication.

Conclusion: Cranial computed tomography provides a useful means of diagnosing intracranial complication of bacterial meningitis although it has limited therapeutic application in these children.

KEYWORDS: bacterial meningitis, cranial computed tomography

INTRODUCTION

Computed tomography (CT) has led to a better understanding of the structural basis for neurologic complications of bacterial meningitis[1]. Its results adequately correlated with the development of these complications[2] as well as with recovery[3]. Furthermore, CT has proven very useful in indicating the need for neurosurgical intervention[4-6] as well as prognostication[7]. Concerns about cost and radiation exposure in the face of a relatively low yield of therapeutically useful information had called for a conservative approach to its utilization[8].

We report our local experience in 60 patients with bacterial meningitis, in whom CT was done for a variety of clinical indications. The diagnostic, prognostic and therapeutic yield of this procedure will be examined and compared with experience from other studies, in an attempt to adopt a more critical approach to the use of this procedure.

PATIENTS AND METHODS

The study involves a retrospective review of the medical records of children under the age of 12 years, admitted with bacterial meningitis over an eight-year period (June 1992 through June 2000), in Al-Adan and Al-Farwania regional hospitals in Kuwait. The diagnosis of bacterial meningitis was based on the presence of cerebrospinal fluid (CSF) pleocytosis with low glucose and high protein concentrations and a positive blood culture. Children with suspected or proven viral meningitis or encephalitis were excluded.

Computed tomography was performed for a variety of clinical indications including seizures, neurological deficits, prolonged or secondary fever, changes in sensorium, head trauma and recurrent meningitis. The CT results were obtained from the reports by the radiologists.

RESULTS

There were 31 males and 29 females. Forty-four children (73%) were under the age of 1 year. A causative organism was identified in 46 patients (77%). Hemophilus influenza type B was the most common (25 patients, 42%) followed by S. pneumonia (11 patients, 18%) and N. meningitidis

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Table 1
The relation between indications for ordering the CT scan in patients with bacterial meningitis and abnormal findings

Indication for CT scan	No. of patients	Abnormal CT scan findings					
		Subdural collection	Brain atrophy/ infarction	Hydrocephallus	Brain odema	Skull fracture	Cripriform encephalocele
1. Seizures	28	9	5	5	1	0	0
2. Neurological deficit	9	2	2	2	1	1	0
3. Fever	18	7	3	3	0	0	0
4. Change in sensorium	12	3	2	1	1	0	0
5. History of head trauma	4	0	0	0	0	1	0
6. Recurrent meningitis	2	0	0	0	0	0	1

Table 2
The relationship between the abnormal findings and patient's age

Indication for CT scan	No. of patients with normal CT findings	Abnormal CT scan findings					
		Subdural collection	Brain atrophy/ infarction	Hydrocephallus	Brain odema	Skull fracture	Cripriform encephalocele
1-3 months	3	5	5	2	0	0	0
> 3 months- 1 year	10	13	3	3	0	0	0
> 1 – 5 years	7	1	0	1	0	0	0
> 5 – 12 years	3	0	0	0	1	2	1
Total number of patients	23	19	8	6	1	2	1

(7 patients, 11%). Pseudomonas, group *B streptococcus* and *M. tuberculosis* were identified as the causative organism in one patient each.

Abnormal CT findings were reported in 37 patients (62%). Details of these findings are depicted against the clinical indication in Table 1. (Note: some patients had two or more of these indications, hence, a CT abnormality may then appear more than once in the table.) Subdural collection (19; 32%), brain atrophy/infarction (8; 13%) and hydrocephalus (6; 10%) were the most frequently encountered CT abnormalities.

The relationship of CT abnormalities to age is depicted in Table 2 and Figure 1. CT abnormalities were encountered in 71% of children aged one year or less as compared to 37% of children over the age of one year. Subdural collection and hydrocephalus were more common with H. infleunzae, while parenchymal abnormalities (Figs. 2, 3) were more common with pneumococcal infections.

There was one mortality in this series. Eight patients had hearing impairment, six had epilepsy and six developed severe neurologic deficit in the form of cerebral palsy. One patient suffered from third nerve palsy and five had hydrocephalus. A total of 78% of these children had CT abnormalities compared to 49% in those without sequelae.

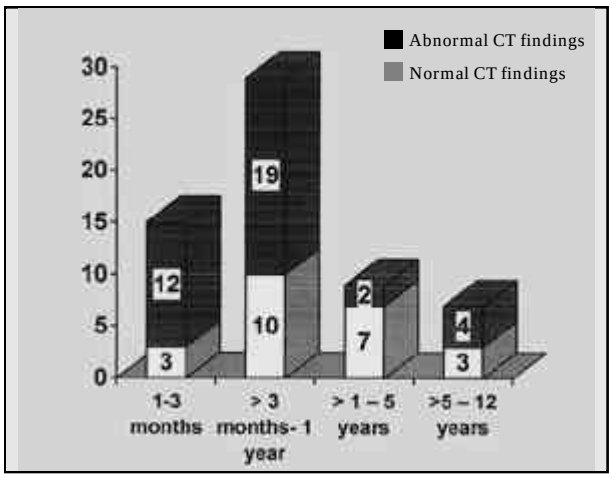

Fig. 1: The relation between age distribution and CT findings in patients with bacterial meningitis

DISCUSSION

The yield of CT abnormalities in this study was high (62%), and is comparable to that of previously reported studies[7,8]. The main indications for doing a CT in meningitis have been the same: seizures, neurologic deficits, prolonged or secondary fever and changes in sensorium[4,8] and our study is not an exception (Table 1).

Earlier studies highlighted the role of CT in leading to a better understanding of the anatomical basis of the complications of bacterial meningitis and showed that it is a disease process which often exerts a profound effect on the brain parenchyma[1,9]. Furthermore, some prominence was given to CT in meningitis, especially in indicating neurosurgical intervention[4,5] and in leading to a better outcome in patients with brain

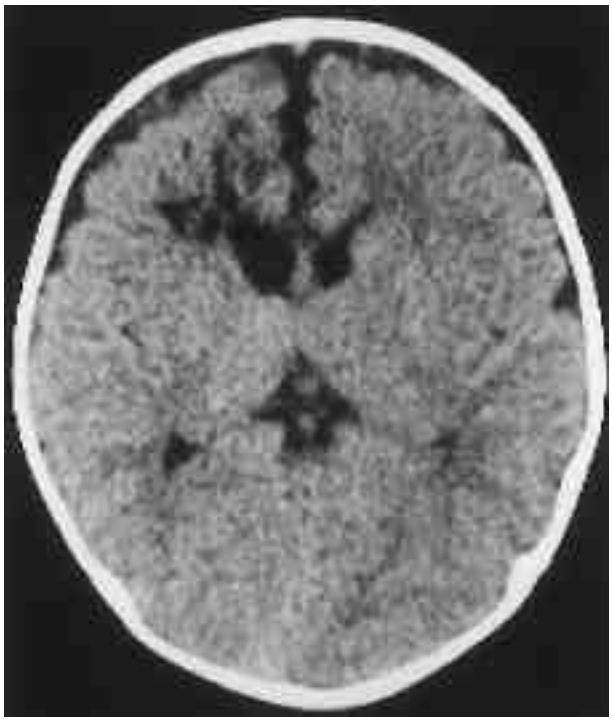

Fig. 2: Cranial CT scan showing early parynchymal changes in a 6-month-old baby with pneumoccocal meningitis

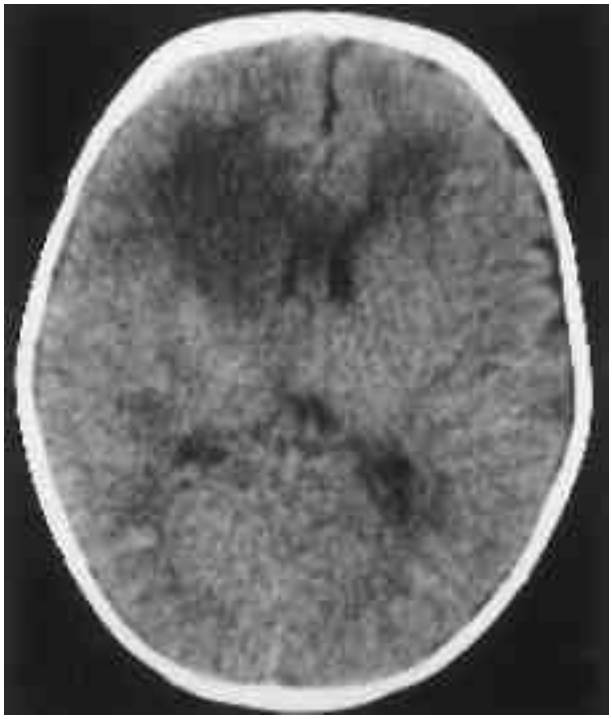

Fig. 3: Follow up of cranial CT scan showing the late atrophic changes in the same patient

abscess[6]; and others have found to be of prognostic value[7].

In our series, CT led to neurosurgical intervention in five patients: two of whom were cured from recurrent meningitis after repair and three more of whom benefited from ventriculoperitoneal shunts or drainage of a large symptomatic effusion. Furthermore, two children had unsuspected skull fractures revealed by CT. The prognostic value of CT in our series was less clear. Although children with sequelae showed more frequency of CT findings (78% to 49% in normal children), the prognostic value in individual patients was difficult to prove.

More recent studies have thrown doubt on the value of CT in management. The yield of useful information, both diagnostically or therapeutically has been low[8] and management has been influenced by CT in only a minority of cases[10-12]. Although in our series the yield was not that low, we agree routine CT should not be encouraged. Its value in prolonged fever has also been questioned[12].

The high frequency of abnormalities invariably leads to parental worries when the parent becomes aware of an abnormality to which there is no intervention. This is particularly difficult in our culture.

We conclude that the routine use of CT in meningitis should be discouraged. Expense, radiation exposure, inconvenience and unnecessary parental worry should all lead to a selective approach. We believe that the procedure should be limited to children with progressive neurological manifestations, where CT remains of value for the possibly indication of neurosurgical intervention.

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