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COMPUTED TOMOGRAPHY STUDY OF COMPLICATED BACTERIAL MENINGITIS

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ABSTRACT

Objective: To monitor the structural intracranial complications of bacterial meningitis using computed tomography (CT) scan.

Design: Retrospective study of medical and radiological records of patients who underwent CT scan over a 4 year period.

Setting: A University Teaching Hospital in a developing country.

Subjects: Thirtythree patients with clinically and laboratory-proven cases of bacterial meningitis who had clinical features of central nervous system complication of the disease.

Outcome measures: Only patients with available complete records were studied with material obtained from the medical records and radiology departments of the hospital.

Results: Persistent headache (30.3%), persistent fever (18.18%), seizures (15.5%) and torticollis (12.12%) were the most common presenting features that necessitated the request for CT scan. Communicating hydrocephalus (36.36%), cerebral abscess (12.12%), multiple areas of cerebral infarction (12.12%) and subdural empyema (9.09%) were the most common CT scan findings. The complications were more common in children aged less than 15 years.

Conclusions: Computed Tomography is an accurate and useful means of diagnosing intracranial complications of bacterial meningitis. Early and effective diagnosis of treatable lesions such as hydrocephalus, cerebral abscess and subdural empyema will help improve prognosis of the patients. There appears to be no alternative to prevention, adequate and early treatment of this condition to reduce its long-term neurological sequelae.

Key Words: Computed Tomography, Bacterial, Meningitis, Complications, Brain. *(Accepted 10 Sept. 2007)*

INTRODUCTION

Meningitis is inflammation of the meninges of the brain and bacterial meningitis is the commonest form of meningitis. In Nigeria and other tropical countries, the symptoms of meningitis may be confused with malaria or typhoid fever at early stages leading to inappropriate or delayed treatment.[1-9] Such symptoms include headache, confusion, fever, malaise, weakness, disorientation, convulsion, neck stiffness and coma.[2-14] Neck stiffness, which is more specific for meningitis may not always be present.[1,2,3,8,9] When the symptoms and signs of meningitis are not classical, patients may be inappropriately treated for malaria or typhoid fever in most centres outside the big private and tertiary hospitals where adequate laboratory facilities exist for diagnosis.[8,9,14] With symptoms of fever and headache, several patients visit alternative health practitioners, patent medicine stores, nursing homes and medical laboratory scientists who lack skills for early clinical identification of cases that are not the common malaria or typhoid fever. Also these paramedical personnel lack admission facilities for adequate treatment leading to inadequate or delayed treatment and their associated complications.[1,2,4,8,9,14] Cases of complicated meningitis due to poor, delayed or inadequate treatment are frequently what reach the teaching hospitals.[14] The roles of radiology in the management of meningitis[9, 10, 11] are to:

1. Exclude ventriculitis, localised empyema or parenchymal abscess.
2. To evaluate the temporal bone (when there is otitis media) and paranasal sinuses as sources of infection.
3. To monitor complications such as hydrocephalus, subdural effusion, or brain infarction.

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This study is to analyse CT scan of patients with meningitis to monitor such complications.

Among the various radiological imaging modalities, ultrasound is useful in the first six months of life.[10,12] Plain radiography may show signs of chronic raised intracranial pressure but the yield is low. CT scan will demonstrate all the lesions that both ultrasound and plain radiography will show. It will further demonstrate all the structural complications of meningitis like hydrocephalus, cerebral abscess or atrophy, empyema, as well as examine the paranasal sinuses and temporal bones.[1,2,3,5,9,11] Magnetic resonance imaging (MRI) has the advantage of not using ionizing radiation and can image in both sagittal and coronal planes with better definition of soft tissue details.[2,5,11] However, MRI is not available in our centre.

Several studies in Nigeria[8,9,14] regarding bacterial meningitis exist but none has focused on the long term complication of meningitis using such powerful tool as computed tomography scan to explore the lesions within the cranium unlike in the rest of Africa.[1,4] This study is aimed at showing the need to assess complications with CT scan so that those conditions amenable to surgical treatment can be appropriately referred.

MATERIALS AND METHOD

Thirty-three patients who were referred to the CT scan unit of Department of Radiology, University of Benin Teaching Hospital (UBTH), Benin City over a 4 year period on account of clinical and laboratory proven cases of complicated bacterial meningitis were studied. These patients were previously poorly treated for meningitis in several private clinics, maternity homes and general hospitals and had CT scan done to detect and monitor such complications. The CT scans done between 1st January 2000 and 31st December 2003 were retrospectively studied and analysed. The CT scan request cards, CT scan duplicate reports and the case notes of the patients were studied and analysed. The information that were assessed include the age, sex, presenting complaint, reason for referral, duration of illness before referral to UBTH and findings of CT scan.

RESULT

The study consisted of thirty-three (33) patients of whom 13 were males and 20 were females with male to female ratio of 1:1.5. The age range varied from 8 months to 34 years and 57.57% were below 15 years (Table 1).

The most consistent presenting symptoms were persistent headache 10 (30.30%), persistent fever 6 (18.18%), seizure 5 (15.15%), torticollis with fever 4 (12.12%), bulging fontanelles 3 (9.09%), loss of consciousness 2 (6.06%), aphasia 2 (6.06%) and paraplegia 1 (3.03%) patients (Table 2).

In the result of the CT scans, normal findings were seen in 6 (18.18%) patients. These consisted of 4 of the 6 patients of age group 30 34 years. Communicating hydrocephalus with severe reduction of the cortical mantle was seen in 12 (36.36%) patients and 10 of them were aged 3 10 years. In adults, only two female patients aged 30 34 years had severe communicating hydrocephalus. Most of the patients with communicating hydrocephalus presented with severe symptoms such as loss of consciousness (n = 2), seizures (n = 3), fever with torticollis (n = 3), paraplegia (n = 1) and bulging fontanelles (n = 3). Cerebral abscess was seen in 4 patients. This appears on CT as hypodense spherical lesions with ring enhancement after injection of contrast. Two of them presented with aphasia while the other two presented with persistent fever. Subdural effusion was seen in 3 (9.09%) patients and these also had non-specific areas of ventricular dilatation and focal cerebral infarction. Communicating hydrocephalus with cerebral hemiatrophy was seen in 3 (9.09%) patients all of whom were below 5 years and presented with persistent fever after inadequate treatment of the meningitis. Four (12.12%) patients had multiple areas of chronic cerebral infarction with localised dilatation of the sulci. Only 1 (3.03%) patient had communicating hydrocephalus with cerebral and cerebellar atrophy. (Table 3)

Table I. **Age Range of Patients**

Age range (Years)	M	F	Total	Percentage
0 – 4	2	10	12	36.36
5 – 9	3	-	3	9.09
10 – 14	-	4	4	12.12
15 – 19	-	-	-	-
20 – 24	8	-	8	24.24
25 – 29	-	-	-	-
30 – 34	-	6	6	18.18
Total	**13**	**20**	**33**	**100**

Table 2: **Presenting Complaint of Patients**

Major Complaint	Number	Percentage
Persistent fever	6	18.18
Loss of consciousness	2	6.06
Seizures	5	15.25
Aphasia	2	6.06
Torticollis with fever	4	12.12
Persistent headache	10	30.30
Bulging fontanelle	3	9.09
Paraplegia	1	3.03
Total	**33**	**100**

Table 3: **Cranial CT Scan Findings.**

CT Scan Findings	Number	Percentage
Normal	6	18.18
Communicating hydrocephalus only	12	36.36
Subdural effusion/empyema	3	9.09
Cerebral abscess	4	12.12
Communicating hydrocephalus with cerebral hemiatrophy	3	9.09
Communicating hydrocephalus with severe cerebral and cerebellar atrophy	1	3.03
Multiple areas of cerebral infarction	4	12.12
Total	33	100

Figure 1. **Communicating Hydrocephalus.**

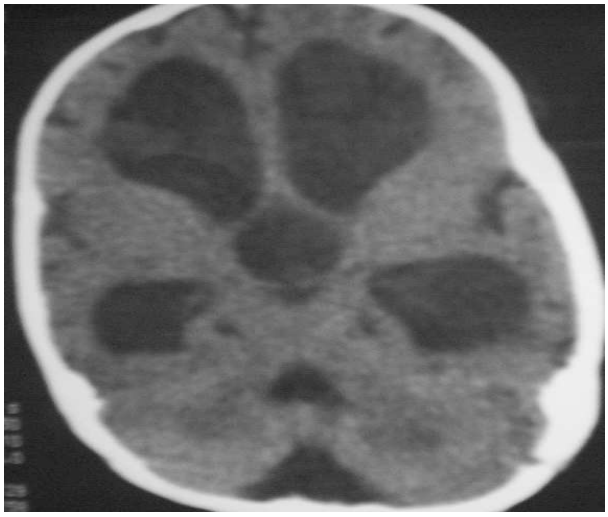
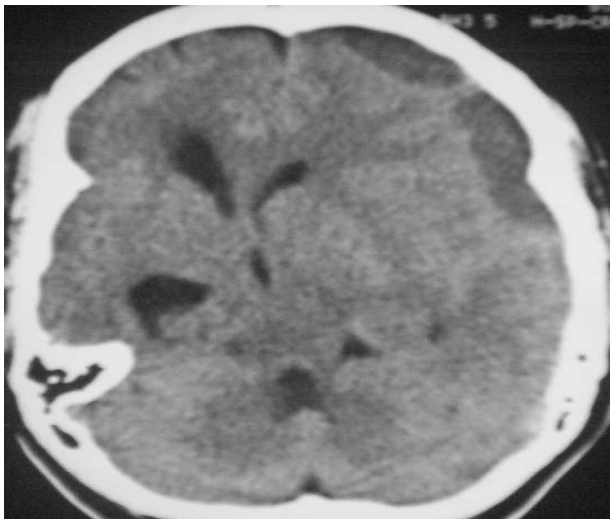


Figure 2: **Severe Communicating Hydrocephalus with Cerebral and Cerebellar Atrophy.**

Figure 3: **Subdural Effusion/Empyema**



DISCUSSION

The commonest age group with complications were children aged less than 15 years (57.57%) compared to in adult (30%). Six (18.18%) patients who had normal scan were adults in the age group 30-34 years. Children are more prone to the complications because of the actively growing brain substance and little space to expand compared to the adult. It also means that paediatric cases should be urged to undergo CT scan for early detection of these complications to minimize future intellectual compromise.[1,2,6]

From the study, it can be seen that only patients with chronic and serious complaint were referred for cranial computed tomography after treatment for bacterial meningitis making this group a highly selected group.

Of the 33 patients studied 27 (81.82%) had serious complication on CT scan and only 6 (18.18%) patients had normal scan. The study agrees with previous study by Klein and Kaplan[13] and other authors,[3,5,10,11] that CT scan provides accurate means of diagnosing intracranial complications of bacterial meningitis. Its use in children with persistent neurological dysfunction is beneficial to elucidate the intracranial complications. Ventriculo-peritoneal shunt to relieve hydrocephalus may help patients with hydrocephalus; therefore, CT scan is advocated for all patients with signs of raised intracranial pressure because of availability of surgical treatment for this condition.[5,8,9,10] However, cost in Africa has continued to limit its use.

Complications such as subdural effusion/empyema can be drained surgically if referred to neurosurgeons. Hydrocephalus results from cellular debris blocking the foramen of Monro, aqueduct, fourth ventricular outlets, and arachnoid villi. Subdural effusion commonly results from

haemophilus influenzae infection in children. Cerebral infarction can lead to brain atrophy. Infarction results from arteritis or venous thrombosis.[1-6] There is the need for a low threshold for initiating radiological investigations whenever there is any reason to suspect the possibility of developing neurological sequelae. Patients should be given the benefit of contributing to decision making in their management. Several patients are an only child, have wealthy relations ready to come to their aid and therefore should be adequately and accurately informed and allowed to exercise their right in the use of investigative modalities and surgical though expensive options of treatment that will better their condition.

There appears to be no alternative to health insurance, adequate prevention and prompt adequate treatment of meningitis to reduce its long-term neurological complications most of which are severe.

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