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Long term neurological complications of bacterial meningitis in Nigerian children

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Abstract *Background:* Neurological disorders in children are common occurrence in clinical practice. The disorder account for more than 170,000 deaths worldwide each year and contributes to the world's disease burden with majority of people affected living in Africa. When affected by such illnesses, a person's memory, motor and cognitive abilities, concentration, speech, and physique can be drastically altered. Many of these disorders are chronic, frustrating to caregivers and parents and require adequate understanding to cope with management. Bacterial meningitis contributes significantly to this morbidity and mortality in sub-Saharan Africa, known as the "meningitis belt".

This study highlights the long term neurological complications of bacterial meningitis amongst children who were on follow up at the neurology unit at the University of Port Harcourt Teaching Hospital (UPTH), a tertiary hospital in Southern Nigeria.

Method: This is a three year follow up prospective study of children with meningitis at the Paediatric neurology unit of the University of Port Harcourt Teaching Hospital, Nigeria between January 1st 2010 and December, 31st 2012. Descriptive analysis was done using SPSS® version 17.

Result and Conclusion: Out of 7,644 patients seen in the department, 624 of them were diagnosed with meningitis given a prevalence of 8.16%.These patients were followed up at least one year in the neurological outpatient clinic to assess the outcome post admission. Those with neurological sequelae were 94 cases (given a prevalence of 15.06%) comprising 58 males and 36 females which gave a ratio of 1:0.6. The most common complication was recurrent seizure disorder in 28(29.79%) of them and motor developmental delay in almost 20% of them. Others are focal neurologic deficits and neuropsychologic impairment. The impact and consequences of meningitis is grave, it is important to prevent the disease at all cost.

Key words: Meningitis, children, Neurologic complications, long-term.

Introduction

Bacterial meningitis is a serious, often disabling and potentially fatal infection resulting in 170,000 deaths worldwide each year [1]. Young children are particularly vulnerable to bacterial meningitis, and when exposed poor outcomes may occur due to the immaturity of their immune systems.[2] The consequences are life threatening. Two thirds of meningitis deaths in low-income countries occur among children under 15 years of age. The main bacterial pathogens causing meningitis beyond the neonatal period are *Streptococcus pneumoniae (pneumococcus), Haemophilus influenzae type b (Hib)* and *Neisseria meningitidis* (meningococcus).[2,3] Serious, long-term neuropsychological complication further increase the population impact of Paediatric meningitis. Survivors of bacterial meningitis risk lifelong sequelae. The incidence, type and severity of sequelae is influenced by the infecting organism, the age of the child and the severity of the acute illness, but it can be difficult to predict which children will develop sequelae. The potential impact of the illness is further complicated by the fact that some of these sequelae may not become apparent until months or years after the acute illness.[4,5]These complications comprise a range of findings with implications for child development and functioning and include such deficits as hearing loss, visual loss, recurrent seizures, cognitive delay, speech/language disorders, behavioral problems and motor delay/impairment.[6,7,8] Others include attention deficit hyperactivity disorder and altered mental status. These long-term problems pose serious hardship for families with limited means to

care for a disabled child, especially in resource-poor settings. The objective of this study was to present a systematic review of the complications following acute bacterial meningitis in children between the ages of 1 month and 15 years who were managed and discharged to the neurology out-patient's clinic for follow up in UPTH.

Patients and Method

This was a three year follow up prospective study of children with meningitis at the Paediatric neurology unit of the University of Port Harcourt Teaching Hospital, Nigeria between 1st January, 2010 and 31st December 2012. The Teaching Hospital was established in 1979. It is the only tertiary hospital located in the metropolis of Port Harcourt, the capital of Rivers State. Nigeria. Port Harcourt lies between longitudes 60 55' and 70 15' east and latitudes 40 35' and 40 46' north. The hospital offers tertiary level of care for its patients and serves as a general/referral centre for neighboring states. Basic demographic details such as, age, sex, tribe, religion, address, occupation of parents, and educational levels of parents were all obtained. The complaints (symptoms) at presentation included recurrent afebrile seizures, recurrent headache, inability to see since discharge from the hospital, inability to walk, inability to attain motor milestones, not hearing, abnormal behavior, stiffness of the body, restlessness, abnormal posturing, hyperactivity and poor learning/ poor academic performance at school. The examination findings (signs obtained) were hypertonia(spasticity of the limbs), hyperreflexia and reduced motor power for those with hemiplegia, visual loss, low intelligence quotient. The patients who were not able to see were referred to the ophthalmology clinic for further evaluation and confirmation of visual loss. The patients with mental retardation and learning disability were assessed using the simple tests for intellectual achievement. Audiological evaluation was done for those with hearing impairment. Radiological investigations such as Computed tomography and/ or magnetic resonance imaging of the brain were carried out when needed. Other parameters recorded included duration of stay in the hospital, duration of antibiotic treatment. Long term complications of meningitis were regarded as the symptoms and signs (sequelae) that were present and observed from three months after meningitis infection. Data were analyzed using descriptive statistics.

Result

Total admissions in the Paediatric unit over the period of three years were 7,644 patients. Out of this, 624 of them were diagnosed with meningitis given a prevalence of 8.16%.These patients were followed up over a period of one year in the neurology outpatient clinic to assess the outcome post admission. Those with neurologic complications were 94 cases. The prevalence of long term complications among the study population was thus 15.06%. The demographic data of the group showed that there were 58 males and 36 females which gave a ratio of 1:0.6. The groups with the largest complications were the 1-5 year olds which made up of 28 males and 16 females, this constituted 46.81%. (Table1). The most common sequelae was recurrent seizure disorder in 28 (29.79%) of the study group. The others were cerebral palsy17 (18.09%), hearing impairment and neuropsychological problems. Table 2 shows the pattern of complications in the study group. The aetiological agent identified in the cerebrospinal fluid culture included streptococcus pneumonia in 31(32.97 %) of the children at the initial presentation prior to treatment. In 46 (48.94%) no pathogen was isolated. The other identified aetiological agents are shown on Table 3.

Table 1: Demographics of the Study group

Age (years)	Sex		Total
	Male	Female	
> 1	15	9	24
1-5	28	16	44
6-10	12	7	19
11-16	3	4	7
Total	58	36	94

Table 2: Types of Neurological sequelae amongst the study group

Type	Number		Percentage
	Male	Female	
Seizure disorder	19	9	29.79
Cerebral palsy	10	7	18.09
Hearing impairment	4	5	9.57
Learning disability	6	3	9.57
Mental retardation	5	2	7.45
Speech impairment	4	2	6.38
Hemiplegia	4	1	5.32
Visual impairment	2	1	3.19
Sleep disturbance	2	1	3.19
Behavioral problem	2	3	5.32
ADHD	0	2	2.13

Table 3: Aetiological agent and number of children with Complications

Aetiological agent	Number affected	Percentage
Streptococcus pneumonia	31	32.97
Mycobacterium Tuberculosis	8	8.51
Haemophilus inflenzae	5	5.32
Meningococcal meningitis	4	4.26
No pathogen identified	46	48.94

Discussion

In the study the under fives were mainly affected with post meningitic neurologic complication. This is similar to other reports.[7, 9] This age bracket heralds the period of maximal brain development and any assault or insult to the developing brain results in neurophysiologic sequelae. Twenty eight (29.79%) of children with long term complications presented with recurrent seizure disorder. This is similar to other studies where seizures occur in

20 to 30 percent of children with acute bacterial meningitis. [2, 10] The pathogenesis of seizures in meningitis is not well understood. Although fever may be a cofactor in very young children, cerebrovascular inflammation or secondary neurochemical changes are presumably the cause of most seizures. Seizures that occur early in the course of bacterial meningitis are easily controlled and are rarely associated with permanent or long term neurologic complications. In contrast, seizures that are prolonged, difficult to control, or begin more than 72 hours after hospitalization are more likely to be associated with neurologic sequelae, suggesting that a cerebrovascular complication may have occurred. [2, 4,9,11] In our study 5.38% of the children had a significant motor impairment that presented as hemiparesis / hemiplegia. This is a focal neurologic complication of bacterial meningitis which is devastating to the affected children and caregivers. Paresis resulting from meningitis generally improves with time. In a study which reviewed about 200 children with bacterial meningitis, hemiparesis and or quadriparesis was noted in 30 patients (12%) shortly after discharge, but persisted in 5 (2 %) one year after discharge.[7] Paresis typically results from an intracranial abnormality such as cortical vein or sagittal vein thrombosis, cerebral artery spasm, subdural effusion or empyema, cerebral infarct or abscess amongst others.[4,9] Other forms of focal deficit amongst the study group was hearing loss in 9(9.57%). This is similar to permanent sensorineural hearing loss which occurred in as many as 11 percent of children with bacterial meningitis. [7, 12] It is known that hearing loss after bacterial meningitis may be transient or permanent. Transient hearing loss may be secondary to a conductive disturbance in many affected patients. [13] However, sensorineural hearing loss (transient or permanent) can result from damage to the eighth cranial nerve, cochlea, or labyrinth, induced by direct bacterial invasion and/or the inflammatory response elicited by the infection.[13,14]

The other very important complication was the neuropsychologic impairment s which we found. 7(7.45%) of the children had mental retardation. This has been recognized in other studies by Peltola H [15]who reported 4% of children with mild to severe intellectual disability (mental retardation). Other sequelae seen in the study included learning disability, behavioral disorder including attention deficit hyperactivity disorder; these have been reported in several prospective studies where outcomes in survivors of bacterial meningitis have been shown to have similar results. [15-20] The main causative organisms identified in our study was streptococcus pneumonia (32%). This is different from that reported by Taylor et al where about 37% was caused by H. influenza .[15.21.22] In 48.94% of cases no pathogen was identified. This may be due to prior use of antibiotics by most of our patients who buy and practice self medication at home many days before presenting to a health facility for proper treatment and management. The inappropriate use of antibiotics gives false negative result in the analysis of the cerebrospinal fluid and blood culture. The correct causative organism will not be obtained in the culture and this may lead to inaccurate drug treatment.

Conclusion

Bacterial meningitis continues to result in substantial morbidity and mortality despite the availability of effective antimicrobial therapy. The risk of developing long term sequaelae /complications is related to the age and underlying condition of the patient, the causative pathogen, the severity and duration of illness at the time of presentation, and, occasionally, due to delays in the initiation of appropriate antibiotic therapy. It is important for clinicians that treat these children to follow them up closely so as to identify those with serious neurological complications. This is important as early detection, instituting prompt management including rehabilitation will go a long way to reduce the incidence of very serious disabilities and improve the quality of life of affected children.

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