African Journal of Microbiology Research Vol. 4(24), pp. 2670-2673, 18 December, 2010
Available online http://www.academicjournals.org/ajmr
ISSN 1996-0808 ©2010 Academic Journals

Full Length Research Paper

Pattern of bacterial meningitis in Sudanese children, Omdurman, Sudan

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Accepted 6 October, 2010

Bacterial meningitis is very serious condition among children less than 5 years, since it might affect the central nervous system (deafness, epilepsy and hemiplegia). We found in this study about half of the cases (48.5%) were due to Meningiococcal meningitis, followed by *Hemophilus influenza*, which account for one-third of the cases (30.3%). Streptococcal pneumoniae is the least common cause of bacterial meningitis in Sudan, which account for only one-fifth of the cases (21.2%). Most of the presentations were fever, convulsion and sign of meningial irritation. Case fatality rate 5 (5.15%), neurological complications account for 12 (12.37%) cases. Vaccination against meningococcal, haemophilus and Streptococcal infection should be considered, because all of the studied cases were unvaccinated, in addition to facilities for investigations should be readily available.

Key words: *Haemophilus influenza,* bacterial meningitis, meningiococcal, streptococcal pneumonia.

INTRODUCTION

Bacterial meningitis is an infection of the leptomeninges of the spinal cord and brain (Muhamed-Kheir and Ala-Eddine, 2010). Bacterial meningitis is most commonly caused by one of three types bacteria: *Haemophilus injluenzae* type b, *Neisseria meningitidis,* and *Streptococcus pneumoniae* bacteria. Before the 1990s, *H. injluenzae* type b (Hib) was the leading cause of bacterial meningitis (John et al., 2002), but the new vaccine regimens, pentavalent and the hexavalent vaccines have reduced the occurrence of serious Hib disease (John et al., 2002). Today, *N. meningitidis* and *S. pneumoniae* are the leading causes of bacterial meningitis bacteriologic and epidemiologic data collected over the past 30 years have consistently established the importance of Group A *N. meningitidis* as the dominant etiologic agent (Marc et al., 2009).

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Bacterial meningitis is found worldwide (John et al., 2002), the bacteria mainly *H. influenza* (John et al., 2002), are spread by direct close contact with the discharges from nose or throat of an infected person (John et al., 2002). All age groups are liable to bacterial meningitis, but it is most common in infants and children. Prolonged contact with a patient with meningitis caused by *N. meningitidis* or Hib increases the risk of acquiring the disease. This includes people in the same household or day-care centre, or anyone with direct contact with a meningitis patient (John et al., 2002).

In patients over the age of 2, common symptoms are high fever, headache, and stiff neck (Muhamed-Kheir and Ala-Eddine, 2010). These symptoms can develop over several hours, or they may take 1 to 2 days (Heather et al., 1988 to 1998). Other symptoms include nausea, vomiting, photophobia, confusion, and drowsiness. In some cases a vasculitic rash may develop (Muhamed-Kheir and Ala-Eddine, 2010). In newborns and infants, the symptoms that appear might be inactivity, irritability,

vomiting, and poor feeding. As the disease progresses, patients of any age may develop seizures (Muhamed-Kheir and Ala-Eddine, 2010; John et al., 2002; Heather et al., 1988 to 1998).

The diagnosis is usually made by a spinal tap that demonstrates a turbid first drop of cerebrospinal fluid, a low glucose concentration, a high protein and neutophil concentration with or without pleocytosis. Identification of the type of bacterial, either by gram stain or by polymerase chain reaction (PCR) techniques, meningitis is important for definitive diagnosis and treatment. The risk of a spinal tap outweighs the complications of advanced bacterial meningitis which can lead to brain damage, coma, and death. Survivors can suffer long-term complications, including hearing impairment, mental retardation, paralysis, and seizures (John et al., 2002).

Early diagnosis and treatment are very important. If disease suspected, the patient should be hospitalized and empiric antibiotics to cover all three pathogens started immediately bacterial meningitis can be treated with a number of effective antibiotics. It is important, however, that treatment be started early. In the United States, bacterial meningitis is relatively rare and usually occurs in isolated cases (John et al., 2002), In parts of Africa, widespread epidemics of meningococcal meningitis occur regularly. In Asia, the incidence ranged between 5.2 to 19.2 and much higher 76 to 105 per 100,000 in South Africa (John et al., 2002). The weighted worldwide incidence of *H. influenzae* meningitis in patients younger than 5 years was 57 to 105.9 per 100,000 before its introduction into the vaccination programs (John et al., 2002; Heather et al., 1988 to 1998). With the wide spread success of the vaccination programs, a rapid decline in *H. influenzae* meningitis has occurred since 1986 (John et al., 2002) Meningococcal meningitis is a continuing threat. Healthy children and young adults are susceptible, and death can occur within a few hours of onset, thus vaccination can play a crucial role in disease mortality control (Muhamed-Kheir and Ala-Eddine, 2010).

The vaccines against *H. influenzae* are safe and are given by age 6 months of age; every infant should receive at least three doses of the Hib vaccine plus a booster between 12 and 18 months of age. The vaccine against *N. meningitidis* is not routinely used and is usually most helpful to control cluster outbreaks. The vaccine against *S. pneumonia* cannot be used in infants under 2 years of age, and is usually given for the old and in pre-splenectomised patients (Scheupner and Sosnowski, 1659).

Objectives

1. To determine the bacterial causes of meningitis in Sudan in children between 2 months - 59 months.
2. Short term complications in cases of meningitis.
3. To study the clinical presentation of bacterial meningitis.

METHODOLOGY

The study was conducted in Omdurman Teaching Hospital (OTH), which is the main children hospital in Omdurman state with catchment area of more than 5,000,000 populations, with 3000 beds covering general paediatrics, on a three-day-per-week basis. All children admitted with clinical diagnosis of meningitis under 5 years old and unvaccinated for meningitis, and negative blood films for malaria were included. The case definition of meningitis is acute onset of fever, refusal of feeding, vomiting, convulsions, bulging fontanelles and neck stiffness plus signs of meningeal irritation that is positive Kerning's sign, Brudziniski sign (is the appearance of involuntary lifting of the legs in meningeal irritation when lifting a patient's head off the examining couch, with the patient lying supine) and/or tripod sign, in which the patient assumes a characteristic position by extending the neck, arching the spine backwards, and flexing the knees and hips (The childhood seizures of coma, 2000; Cheesbrough, 1991).

A pre-coded questionnaire on medical, social and family history was completed after obtaining informed verbal consent. Thorough clinical examination for each child was then conducted. Two milliliters (mls) of venous blood were drawn from all cases for estimation of haemoglobin, blood counts, blood culture and blood sugar. Cerebrospinal fluid (CSF) was withdrawn from cases suspected as meningitis, examined for pressure, macroscopic appearance, cytology, gram stain, sugar, protein and serology. Two mls of CSF were spared for culture in transport media (TIM), then sub cultured in GCII chocolate (GCH) chocolate and chocolate agar incubated for 24 to 72 h in 10% Co (Pimmeniel and Ismail, 2003) atmosphric 37°C then chemical test such as gram stain, catalase oxidase CAPI haemophilus that is analytic profile index. Serotyping was done using specific antisera for *H. influenza* type b and quality control was performed using standard control (Salih, 1990). Then follow up for complication is performed every 2 weeks. Simple tabulation of the data was performed using Epinfo V6b software and the SPSS program was used for analysis with X2 of 0.05 level of significance.

RESULTS

Table 1 shows the clinical presentation in cases of meningitis in Omdurman teaching hospital for children. Table 2 shows that 20 cases in a percentage of (17.09%) were not done due to lack of samples for culture. Although the CSF analysis was done for bacteria detection, but it shows more negative cases that may be due to viral infection. Table 3 shows that the dominance of *N. meningitides* among children in Africa. Table 4 shows the outcome of meningitis on patients after 3 weeks.

DISCUSSION

The study was performed between 2003 to 2004 (one year duration, in Omdurman Children's Hospital) with an objective to determine pattern and spectrum, together with short term outcome of infection caused by Hib of

Table 1. Clinical presentations of meningitis (n = 117).

Clinical presentation in	No. of patients	Percentage (%)
Meningitis		
Fever	117	100
Neck rigidity	117	100
Convulsion	106	90.9
Krnig's sign	106	90.9
Refusal of feeding	95	81.5
Brudzinski	69	59
Bulging fontanel	53	45.5
Cough	31	27.0
Running nose	15	13.4
Tripod sign	5	4.5

Table 2. CSF culture distribution of cases of meningitis (n = 117).

Result of culture	No. of patients	Percentage (%)
Positive cases	33	28.21
Negative cases	64	54.70
Not done	20	17.09
Total	117	100.00

Table 3. Pattern of bacterial meningitis according to culture (n = 33).

Result of culture	No. of patients	Percentage (%)
N. meningitides	16	48.49
H. influenza	10	30.30
S.pneumoniae	7	21.21
Total	33	100.00

Table 4. The outcome of after 3 weeks, meningitis (n = 97).

Clinical presentation in	No. of patients	Percentage (%)
Meningitis		
Full recovery	80	85.4
Death	5	4.3
Haemplegia	4	3.4
Deafens	2	1.7
Epilepsy	2	1.7
Loss of follow up	2	1.7
Cerebral palsy	1	0.9
Hydrocephalus	1	0.9
Total	97	100.0

children less than 5 year old. The study gave a reasonably idea about the causes and severity of the bacterial organisms that cause meningitis. The most common and serious cause of bacterial meningitis in children less than 5 years was *N. meningitides*, which lead to meningitis in half of the cases, this is in contrast to prior reports. Given that there is a decade difference between the two studies direct comparison may not be accurate (Nakhla et al., 2003), and also differ from records from Ministry of Health in Sudan Campbell and Mgintodh, 1998. This difference in results is well explained by better awareness and advance investigations that were not available in Sudan previously and also there is a gap of three decades between the two studies. Also this study has similar findings in other African countries (Yousif, 2004). The incidence of fever and neck stiffness is similar to prior studies in Sudan Nakhla et al., 2003. The CSF analysis has been done for bacterial meningitis detection in this study, but the dominance of negative outcome was reclassified and treated as viral etiology, considering that bacterial meningitis requires immediate treatment and aseptic meningitis usually does not.

In conclusion, this is a serious infection with serious complications, early diagnosis and treatment lower mortality. Preventative measures by vaccines should be strongly considered for all children and reevaluation of the health care budget should be considered to accommodate vaccines.

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