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EPIDEMIOLOGICAL FEATURES AND OUTCOME OF MENINGOCOCCAL MENINGITIS OUTBREAK IN CHILDREN IN MAIDUGURI, BORNO STATE, NIGERIA

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ABSTRACT

Meningococcal meningitis remains a major public health problem among children in Nigeria especially in the meningitis belt. Many epidemics of the disease have occurred in the past in Borno state, with little effort to control them. The last of such occurred in 1996 with devastating effects. This study presents the epidemiological features, treatment and outcome of the outbreak.

All children who were admitted into the State Specialist Hospital with a clinical diagnosis of meningitis between January and May 1996 were recruited into the study. Demographic information as well as history of their Immunization was ascertained. In addition, lumbar puncture was done on all patients except where contraindicated.

A total of 285 children, 171(66.7%) male and 114(33.3%) females between the ages of one week and 14 years with a mean of 6.31 years were admitted during the study period, most of who were from the low socioeconomic background.

Overall mortality rate was 21.4% with the highest among children below the age of 6 months (35.3%). Mortality decreased with increasing age. The highest number of cases was recorded in March, which is the beginning of the hot season. The sex of the child did not affect the outcome of the disease. Early immunization with the polyvalent group A and C polysaccharide vaccine is strongly recommended as well as improved living conditions.

INTRODUCTION

Childhood acute bacterial meningitis is a major health problem in both developed and developing countries[1,2]. Within the African continent, severe periodic epidemics of group A Neisseria meningitidis disease occur every 6 - 12 years in its savannah zone that extends within latitude 5° to 15° N. Maiduguri, the capital of Borno State of Nigeria, situated on latitude 11° N which falls within the meningitis belt of Africa has experienced periodic large epidemics of meningoccocal meningitis since 1921[3]. The April 1986[4] and January 1996 outbreaks of cerebrospinal meningitis (CSM) caused by N. meningitidis occurred in Maiduguri and several other villages in the state. Such outbreaks as they affect children have never been studied. In the present study, we report the epidemiological features, treatment and outcome in a prospective cohort of children during an epidemic.

PATIENTS AND METHODS

The study population consisted of all children who were admitted with a clinical diagnosis of Meningitis in the children's ward of the State Specialist Hospital, Maiduguri during the period of the epidemic (January to May 1996). Demographic information such as age, sex and place of residence of affected children were documented. History of previous immunization against meningitis was sought. The signs and symptoms at presentation and course of illness were carefully documented.

A lumbar puncture was done on all patients on admission during the epidemic except where contraindicated in which case it was delayed until the patient stabilized[5]. Each cerebrospinal fluid (CSF) specimen was examined for appearance, Gram stained smear using direct microscopy and culture. Each sample of CSF was also analyzed for glucose and protein. A concomitant random blood sugar was also assessed in all patients. All patients had antibiotic treatment in the form of a combination of chloramphenicol at 100mg/kg/day and ampicillin at 400mg/kg/day intravenously in four equally divided doses.

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RESULTS

From January to May 1996, a total of 285 children with a diagnosis of meningitis were admitted to the paediatric unit of the state Specialist Hospital, Maiduguri. There were 171 males and 114 females (male: female ratio, 3:2,). The ages ranged from 1 week to 14 years with a mean of 6.31yrs. The highest prevalence was observed in the 4 - 9 year age group 104 (36.5%). Four (1.4%) children were less than one month of age, while 13 (4.6%) were between 1- 6 months of age. Two hundred and fifty six (90%) were children of junior civil servants, peasant farmers or petty traders; the remaining 29 (10%) are children of either senior civil servant or businessmen.

The commonest symptoms were fever, irritability, vomiting and headache especially in the older age group. Neck stiffness and positive Kernig's sign were the commonest signs. Bulging anterior fontanel was observed frequently in patients under the age of two years, while 75(26.3%) patients had altered state of consciousness [6], the remaining 210(73.7%) patients had normal state of consciousness at the time of admission. One hundred

and sixty five (61.5%) patients were vaccinated with the polyvalent group A and C polysaccharide vaccine. The entire gram- stained smears showed the presence of Gram-negative diplococci. Neiseria meningitidis sero group A was found to be responsible for this epidemic.

The total number of death was 61 (21.4%). Mortality for those below the age of six months was 35.3% (6 of 17), 33% (11 of 36) below the age of 12 months and 20% for those above the age of 12 months. There was no difference between male and female in the outcome of the disease, that is, the rates of death and survival were the same in both sexes. Appearance, and presence or absence of CSF pleocytosis did not influence outcome of the disease. The age distribution and age related case fatality ratios are shown in Table 1.

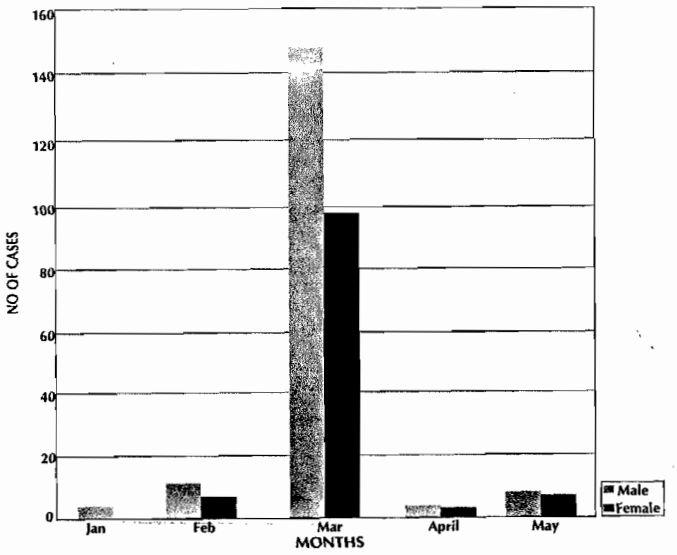
Table 1: **Meningitis Cases by Age and Case Fatality Rates (%) in Children; Maiduguri, Nigeria January - May 1996**

Age in months and years	Cases (%)	Deaths/Case Fatality (%)
< 1 month	4 (1.4)	2 (50.0)
1-6 months	13 (4.6)	4 (30.8)
7-12 months	19 (6.7)	5 (26.3)
1-4 years	88 (30.9)	20 (22.7)
5-9 years	104 (36.5)	19 (18.3)
10-14 years	57 (18.2)	11 (19.3)
Total	**285**	**61 (21.4)**

The monthly distribution of infection is shown in figure I. The peak incidence of infection was observed in March with 87% of cases.

Fifty one of the 75(68%) patients who presented with coma or altered mental state died while only 10 of the 210 (4.8%) patients with normal mental state died. The difference was statistically significant ($P < 0.001$).

Figure 1: **Monthly distribution of N. Meningitis in Hospitalized Children in Maiduguri, Nigeria. January - May 1996**



DISCUSSION

This epidemic, like most other epidemics of meningitis occurred in the hot and dry period. The relationship between epidemics of meningococcal meningitis and high ambient temperatures with low humidity is well established[7]. This epidemic however, differs from the previous ones in the sense that even neonates and infants less than 6 months of age were affected. A previous report[4] has highlighted the probable reason for this as early weaning of infants from breast milk in an attempt to copy the life style of developed countries with mothers weaning their offspring earlier.

The mortality of 21.4% observed in the study is similar to the 19% fatality rate observed in the Stiehm - Damrosch study[8]. In this study however, the age specific case fatality rates were observed to be higher in the younger age groups especially children under the age 12 months. Bwala et al[4] also reported poor outcome in young children during the 1986 epidemic. The poor outcome in the young may is perhaps as a result of the non-specific presentation and therefore delayed diagnosis and treatment in addition to the poor antibody responses in the young infants.

The preponderance of males in this study is as found in previous reports[4, 9,10], although the reason for this has not yet been explored. Despite the relatively higher incidence in males, sex did not seem to influence the overall outcome of the disease as both death and survival rates were the same in male and female.

In spite of the fact that epidemics of meningococcal meningitis are known to occur every 6 - 12 years in the meningitis belt of Africa, little or no preparation was put in place to prevent such an epidemic in 1996 in anticipation of a possible epidemic. This would have been very relevant since the serious epidemic occurred in 1986[4]. An early warning system to detect epidemic is of fundamental importance in preparedness for epidemics. For early detection of cases of meningococcal meningitis, there must be effective surveillance. Early detection of cases will provide an opportunity to prevent cases through vaccination.

Although 61% of our patients were vaccinated, vaccinations were received less than one month before onset of illness in majority of our patients. It has been shown that antibody responses were maximal one month after vaccinations among adults[11]. Unfortunately, meningococcal polysaccharide vaccines are poorly immunogenic in children under 2 years of age, the reason thought for the poor outcome in that age group in our study. It is therefore advocated that immunization be adjunctive to chemoprophylaxis in children, if exposed. Late intervention measures, coupled with poor antibody response put the young infant at a greater risk of dying from meningococcal meningitis during epidemics.[4]

In this study, roughly two thirds of the patients who died, succumb within 24 hours of hospital admission; and almost 95% died within 48 hours of admission. This observation is similar to a previous report[12]. These alarming revelations emphasize the need for prompt diagnosis and treatment.

The peak incidence of infection was observed in March, the onset of dry season. This period is often described as the hottest and driest month of the year with ambient temperature and humidity readings of 40^{0C} and 14% respectively.

We compared several clinical factors with outcome. Several factors were not related to death from meningococcal meningitis including history of fever, headache, and presence of bulging anterior fontanel. Factors that were related to death from meningococcal meningitis ($P<0.001$) are; first 48 hours of admission, age less than one year at the time of infection and altered mental status.

Similarly, we observed that altered mental status at the time of presentation was associated with increased risk of dying. It is suggested that the presence of altered level of consciousness becomes a red flag and therefore the need for Intensive Care Management. Tesoro and Selbst[6] previously reported this observation.

In conclusion, the 1996 outbreak of meningococcal meningitis in Maiduguri, Borno State affected all categories of children and was associated with poor outcome in the very young age group. This calls for early vaccination of all age group of children to counter the outbreak of disease as suggested by Bwala et al [4]. In addition, health education on the early signs and symptoms of the disease, improved living conditions such as proper ventilation and occupancy are also important preventive measures.

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