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OUTBREAK OF CEREBROSPINAL MENINGITIS IN KEBBI STATE, NIGERIA

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ABSTRACT

Background: **Cerebrospinal meningitis (CSM), is a major public health problem still affecting tropical countries particularly in sub-Saharan Africa. Group A and occasionally group C account for large scale epidemics in many countries in the African meningitis belt. The study aimed to describe the pattern of cerebrospinal meningitis outbreak in Kebbi state in 2015.**

Method: **Information on cases and deaths was collected throughout the duration of the meningitis outbreak in all affected local government areas of Kebbi state. During this outbreak, we defined a suspected case as any person with sudden onset of fever (>38.5 C rectal or 38.0 C axillary) and one of the following signs: neck stiffness, altered consciousness or other meningeal signs and any toddler with sudden onset of fever (>38.5 C rectal or 38.0 C axillary) and one of the following signs: neck stiffness, or flaccid neck, bulging fontanel, convulsion or other meningeal signs. All the data was entered into SPSS statistical software and analyzed.**

Results: **A total of 1,992 suspected cases of CSM were seen within the 18 weeks that the outbreak lasted. 1127 (57.0%) were males and 865 (43.0%) were females with a case fatality rate of 4.0%. The highest proportion of cases was found among those above 15 years of age (31.0%), 1252 (62.9%) of cases were immunized against neisseria meningitides type A. Two-thirds (16) of the LGAs in the state were affected and Aliero LGA had about half (n=1106; 55.5%) of cases seen. Most (77.3%) of samples analysed were positive for Nm type C.**

Conclusion: **Kebbi state experienced an outbreak of cerebro-spinal Meningitis in 2015 which was massive. Effective surveillance system and mass vaccination with polyvalent vaccines containing serogroup C will prevent future occurrence.**

Keywords: Meningitis belt, MenAfriVac, Neisseria meningitidis type C, Sub-Saharan Africa

INTRODUCTION

Cerebrospinal meningitis, also called epidemic meningococcal meningitis, is a major public health problem still affecting tropical countries, particularly in sub-Saharan Africa. It is highly contagious and mortality from the disease remains high, despite major achievements in the treatment modalities. It is reported that 4 – 17% of patients die despite treatment.[1, 2] Neisseria meningitidis has 13 known serotypes worldwide with groups A, B and C being the commonest cause of diseases worldwide.[3] Groups A, B, C, Y, and W-135 are responsible for most of invasive disease in both developed and developing countries, whereas, group A and occasionally group C account for large scale epidemics in many countries particularly in sub-Saharan Africa.[4, 5] The African meningitic belt region comprises of 25 countries stretching from Senegal to Ethiopia with a total population of about 500 million people).[6]

In the African meningitis belt, and specifically within northern Nigeria, most meningitis outbreaks have been caused by *N. meningitides* serogroup A (NmA).[2, 7-10] A particularly severe epidemic of meningococcal meningitis occurred in Nigeria between January and June 1996, with 109,580 recorded cases and 11,717 deaths, with a case fatality rate of 10.7%. This was the most serious epidemic of CSM ever recorded in Nigeria, and may be the largest in Africa this century.[11] It took over 3 months and the combined efforts of a National Task Force set up by the Federal Ministry of Health, the World Health Organization (WHO), United Nations Children Fund (UNICEF), United Nations Development Fund (UNDP), Médecins Sans Frontières (MSF), the International Red Cross and several other non-governmental organizations to bring the epidemic under control.[11]

Nigeria with support from the Global Alliance for Vaccine Initiative (GAVI) introduced MenAfriVac– a vaccine which protects against the most prevalent type of Nm serogroup A. Mass campaigns was carried out in all CSM high risk states including Kebbi state with the expectation that it would prevent more than 150,000 deaths by 2015 as well as avoid significant disability and have considerable economic benefits.[6]

In the past 15 years, there has been increasing number of large outbreaks caused by *N. meningitidis* serogroups W135 and X in Niger, Burkina Faso and northern Ghana.[7] Outbreaks due to *Neisseria meningitidis* serogroup C (NmC) have also occurred but were smaller and less frequent than NmA outbreaks.[2,10] The last NmC outbreak in this region occurred in 1979 in Burkina Faso with 539 cases reported (attack rate (AR) 517/100,000).[7] Outbreaks caused by NmC in northern Nigeria are rare, with the last and only recorded outbreak in 1975 with no detailed report published. Other notable NmC outbreaks occurred in the 1970s in Sao Paulo, Brazil and Ho Chi Minh, Vietnam with 2005 (11/100,000 people) and 1015 (>20/100,000 people) cases respectively.[7] In the USA, morbidity and mortality are higher among young adults in outbreaks caused by NmC compared with other serogroups.[7]

Nigeria has not recorded any major outbreak of meningitis since 2012 because of the introduction of MenAfriVac vaccine in December 2011. In 2011, 7.4 million eligible Nigerians were immunized, in 2012 another 7.5 million and in 2013 yet another 7.8 million. Because of this, no major outbreak of meningitis has been experienced. The vaccination offers a minimum of 10 years protection to maximum of lifelong protection.[6] In response to meningitis A (NmA) outbreak that occurred in Sokoto and Kebbi states between 2008 and 2009, Médecins sans Frontières (MSF) conducted reactive vaccination using polysaccharide ACYW135 vaccine.[7] There has been no mass vaccination specifically targeting NmC alone in this region.[7] This paper describes the general characteristics of an outbreak due to a strain of NmC in Kebbi State, Nigeria in 2015.

MATERIALS AND METHODS

Study area

Kebbi state, located in Northwestern Nigeria and lies in the African meningitis belt. Outbreaks of meningitis were a usual occurrence until 2010 when MenAfriVac (vaccination against Meningitis serogroup A) was rolled out and outbreaks in the state stopped. The state has 21 local government areas (LGAs) each with a General hospital and a network of Primary health centres (PHCs) in almost all wards. Each LGA has a Disease Surveillance and Notification Officer (DSNO) who is responsible for collating data from the ward focal person stationed in each ward. There is also a Federal Medical Centre located in the state capital.

Study design

The study design is a descriptive secondary data analysis. During this outbreak, the following case definitions were used:

Suspected meningitis case: Any person with sudden onset of fever (>38.5 C rectal or 38.0 C axillary) and one of the following signs: neck stiffness, altered consciousness or other meningeal signs.

Any toddler with sudden onset of fever (>38.5 C rectal or 38.0 C axillary) and one of the following signs: neck stiffness, or flaccid neck, bulging fontanel, convulsion or other meningeal signs.

Probable meningitis case: Any suspected case with macroscopic aspect of its CSF turbid, lousy or purulent; or with microscopic test showing Gram negative diplococcus, Gram positive diplococcus, Gram positive bacillus; or with leukocytes count more than 10 cells/mm^3.

Confirmed meningitis case: Isolation of the causal pathogens (N. meningitidis, Streptococcus pneumoniae, Haemophilus Influenzae b) from the CSF of a suspected/probable case or by haemoculture or PCR.

Data collection

Ward focal persons working in health facilities are responsible for collating Meningitis surveillance data. Disease surveillance and notification officers (DSNOs) contacted all health posts in their jurisdiction each week and linked suspected cases to the treatment camps for investigation and treatment. Information on cases and deaths was collected using a standard line-list during each week of the meningitis outbreak. Information collected included patients age, sex, residence, signs and symptoms, date of start of symptoms, medication received before presentation. At health camps, information for each case was recorded in a standardized line-list. Cerebrospinal fluid specimen was taken from 75 (3.8%) patients for analysis. Initial serogroup confirmation was by rapid Pastorex agglutination tests. Cerebrospinal fluid samples from suspected meningitis patients were sent to the Reference Laboratory where bacterial isolates, serogrouping and antimicrobial sensitivity testing were performed.

Data analysis

All line-listed data were entered into Microsoft Excel and SPSS version 20.0. Data editing was performed by running frequencies and descriptive statistics for all

variables to check for incompletely filled data which was excluded from analysis. Median age and age range was calculated (non-parametric data). Frequency tabulation was done for all the variables namely; age, sex and geographical distribution. An epidemiological curve showing the time trend of the cases was also done using excel. The proportion of cases immunized against meningitis, proportion from whom CSF specimen was taken and proportion positive from testing were all tabulated.

RESULTS

Socio-demographic data

From the 5th to the 22nd epidemiologic week of 2015, 1,992 suspected cases of CSM were seen and managed at various health facilities in the state. One thousand one hundred and twenty seven (57%) of cases were males while 865 (43%) were females giving a male: female ratio of 1.3: 1 (Table 1). The highest proportions of cases were found in those above 15 years of age (31.0%), 10 - 14 years (27.7%) and the 5 – 9 years (27.4%) (Table 1). Sixteen (16) of 23 LGAs in Kebbi state (two-thirds of the LGAs) reported cases and Aliero LGA had the highest number of cases seen (55.5%) (Table 1).

Epidemiologic data

An epidemic curve drawn showed that it was a propagated epidemic with bimodal peaks. The initial peak was in the 8th week (n=253 cases) and a second peak in the 13th week (n=304 cases) (figure 1). One thousand two hundred and fifty two (62.9%) of the cases had received vaccination against Nm type A within the last 3 years prior to the outbreak (Table 2). Fifty eight (77.3%) of the 75 CSF samples taken from cases were positive for Nm serogroup type C (Table 2). Five (6.7%) of which were either inadequate in quantity or had spilled and were unsuitable for laboratory analysis (Table 2). Eighty (80) deaths were recorded from the treatment centres giving a case fatality rate (CFR) of 4.0% (Table 2).

Table 1: Socio-demographic characteristics of the cases

Variable	Number (n = 1992)	Percent
Age group		
< 1 year	13	65.3
1 – 4 years	261	13.1
5 – 9 years	546	27.4
10 – 14 years	552	27.7
≥ 15 years	618	31.0
Unknown	2	0.1
Sex		
Male	1135	57.0
Female	857	43.0
LGA		
Aliero	1106	55.5
Jega	323	16.2
Zuru	160	8.0
Bunza	117	5.9
Maiyama	74	3.7
Argungu	63	3.2
Arewa	50	2.5
Gwandu	36	1.8
Birnin kebbi	22	1.1
Bagudo	10	0.5
Dandi	8	0.4
Augie	7	0.4
Sakaba	7	0.4
Suru	6	0.3
Koko/ Besse	2	0.1
Fakai	1	0.1

Table 2: Vaccination, CSF and outcome of treatment characteristics of cases

Variable	Number	Percent
Received vaccine (n = 1992)		
Yes	1252	62.9
No	740	37.1
CSF specimen taken (n = 1992)		
Yes	75	3.8
No	1917	96.2
CSF specimen result (n = 75)		
Positive	58	77.3
Negative	12	16.0
Unknown	5	6.7
Outcome of cases (n = 1992)		
Alive	1912	96.0
Dead	80	4.0

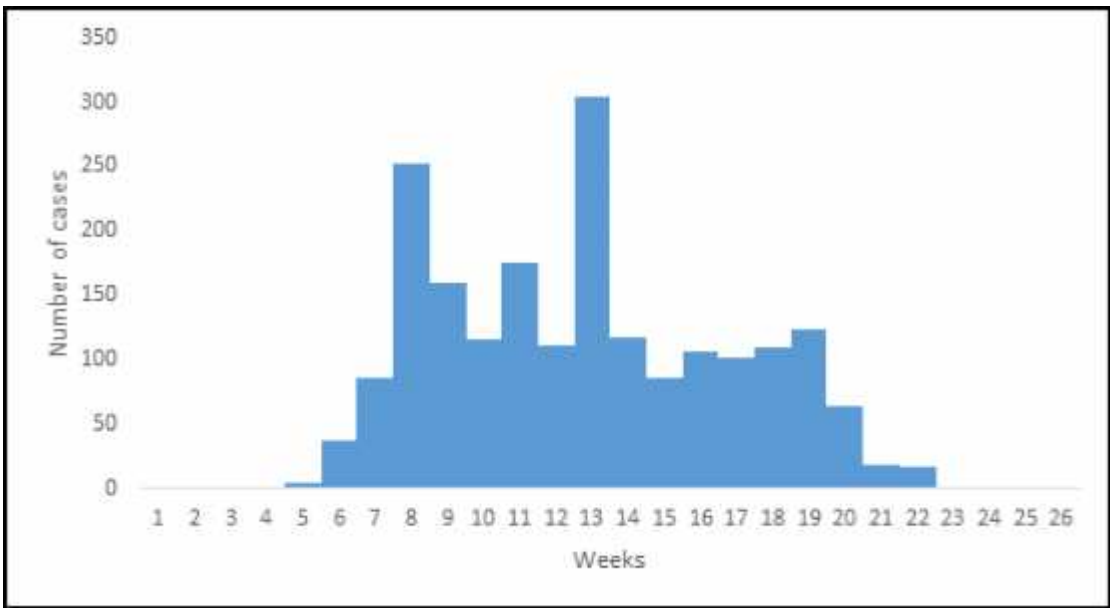

Figure 1: Distribution of cases of CSM by week of onset in Kebbi state in 2015

DISCUSSION

Meningococcal meningitis is primarily a disease of young children, but in epidemics, a variety of clinical presentations may be seen. This data shows a relative sparing of the under 5 year olds as only 13.8% of cases belonged to this age group. This finding is similar to previous but smaller outbreaks in neighbouring Yabo and Silame LGAs of Sokoto state in 2013 - 2014.[7] It is also similar to findings from another outbreak in Gusau, Zamfara state where majority of cases were among the 5 – 14 years and the 15 – 29 years age group.[12] The much higher presentation seen in older children and adults in recent epidemics may be worth taking up as a research problem to be investigated in subsequent researches.

Outbreaks of Neisseria Meningitides (Nm) type C has been on the increase since 2013 in Sokoto and Kebbi states in Northwest, Nigeria.[7] Eight hundred and fifty six (856) cases were reported in Sokoto state in 2013 with a case fatality rate (CFR) of 6.8%. Kebbi state had less than 200 cases in 2013, 333 cases with a CFR of 10.5% in 2014.[7] The 2015 figure gives an alarming 5 fold rise in the number of cases seen compared to that of 2014. This implies it could get worse in subsequent years if no public health measures are put in place to stop the trend.

The case fatality rate for 2015 (4.0%) was less than half that of 2014 (10.5%) though it involved more than twice the number of deaths reported in 2015 (80

deaths) when compared to 2014 (35 deaths). The relatively lower CFR in 2015 was possibly due to the effect of health education/promotion messages given to affected communities and the state as a whole via the mass media during the 2014 outbreak. This led to better health seeking behavior at treatment centres in 2015 and therefore the relatively better health outcomes. Strengthening the surveillance system to make it more effective (sensitive and specific) and giving DSNOs and healthcare workers refresher training on how to promptly identify Meningitis cases will further help in reducing Meningitis burden. The case definitions of Meningitis should be conspicuously displayed at health facilities to help health workers identify cases.

Outbreaks of NmC in Nigeria are rare, the most recent documented outbreak of this serotype in Northern Nigeria was in 1975 before its resurgence in 2013. There is a possibility of emergence of new strains or less commonly seen serogroups such as NmC following mass vaccination campaigns against a particular serogroup. In this case MenAfriVac a conjugate vaccine against serogroup "A" was used for vaccination campaigns between 2012 and 2013 in Kebbi state.[7] Serogroup replacement following mass meningitis vaccination has been noted in West Africa; reports from Niger republic and Burkina Faso have indicated a significant increase in serogroup W135 prevalence in the years following campaigns with MenAfriVac® around 2010.[13, 14] More recently in Nigeria mass vaccination campaigns with monovalent oral polio vaccine against (OPV_1) led to an outbreak of the less common wild polio virus type 3 (WPV_3). This necessitates the need for the use of multivalent vaccines especially in scenarios where more than one serogroup has epidemic potential and the need for strengthening instituted enhanced surveillance systems.

CONCLUSION

Kebbi state has experienced seasonal outbreaks of cerebro-spinal Meningitis (serogroup Nm C) since 2013 with a massive outbreak in 2015. Mass vaccination campaigns have been carried out in previous years against Nm A (MenAfriVac) with about two thirds of the cases immunized. There is a need to vaccinate vulnerable populace with polyvalent vaccines containing serogroup C to prevent future occurrence.

DECLARATION

We wish to declare that all the authors participated in the analysis, data collection and write up however the main author conceived the work. This manuscript has never been submitted for publication in any journal either in part or in whole.

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