

# Susceptibility Pattern Of Meningococcal Meningitis Outbreak In Nguru, Yobe State, North-Eastern Nigeria

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## Citation

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## Abstract

**Background:** The study area lies within meningitis belt, and epidemic outbreaks are common occurrence. Effective treatment of meningococcal meningitis depends on administration of appropriate antibiotics. The study reviewed the antibiotic susceptibility pattern of bacterial pathogens implicated in meningococcal meningitis in the study area. **Methods:** This is a retrospective study conducted during the epidemic period (January –May 2009). The CSF specimens were examined by standard bacteriological methods. **Results:** Of the 110 CSF specimen examined, 54 (49.1%) were positive by Gram-reaction, 32 (59.3%) yielded bacterial growth, with *Neisseria meningitidis*, 25 (78.1%), *Strep. pneumoniae* 4 (12.5), coliforms 2(6.3%), and *S.aureus* 1(3.1). Twelve of the 25 *N. meningitidis* were recovered from children aged less than 60 months with youngest less than 2 months. From the study the bacterial isolates were susceptible to ceftriaxone (100%), chloramphenicol (92.3%) and penicillin (50%) respectively. **Conclusion;** The high sensitivity of the organisms to ceftriaxone (100%) and chloramphenicol (92.3%) as observed in this study is in support of their use as first-line antibiotics in the treatment of epidemic meningococcal meningitis as advocated by the World Health Organization.

## INTRODUCTION

The recent meningococcal outbreak is a continuum of an event observed in sub-Saharan Africa since 1840.<sup>1</sup> Since the early 1900s, periodic large outbreaks of meningococcal meningitis have been experienced in Nigeria, which lies in the African meningitis belt.<sup>1,2</sup> Northern Nigeria has experienced five major epidemics of meningococcal meningitis in the last 40 years, 1970, 1975, 1977, 1986, 1996,<sup>3</sup> and smaller other outbreaks.<sup>4</sup> The 1996 epidemic was the severest, with over 11,717 deaths recorded.<sup>3</sup>

Epidemiological changing pattern of the meningococcal outbreaks, including susceptibility of *Neisseria meningitidis* (*N. meningitidis*) to antibiotics, has been reported over the years.<sup>3-6</sup>

World Health Organization (WHO) recommends the use of chloramphenicol and ceftriaxone as first-line drugs during outbreaks of meningococcal meningitis.<sup>7</sup>

Single intra-muscular injections of oily chloramphenicol have proven effective during outbreaks.<sup>1,3</sup> It has the advantage of being effective, cheap and it is easy to administer. However, resistance to chloramphenicol and a

decreasing sensitivity pattern has been reported in some parts of the world.<sup>5</sup>

Parenteral penicillins have also been recommended in the treatment of meningococcal disease in the industrialized world.<sup>1,8</sup>

From January to May 2009, there was an outbreak of meningococcal disease in Nguru and its environs, and oily chloramphenicol and ceftriaxone were widely used in the management of patients, in line with WHO recommendations.<sup>7</sup>

This study was undertaken to determine the suitability of such a recommendation in Nguru, in the face of reports of changing pattern of antibiotic sensitivity of *N. meningitidis* and also to determine the susceptibility of the bacteria to other commonly used antibiotics, such as penicillins.

## PATIENTS AND METHODS

Federal medical centre Nguru is the only tertiary health centre in Yobe State that serves as a referral hospital and also for catchment areas such as Hadeja in Jigawa State. The hospital also serves patients from neighbouring country of

Niger Republic. Nguru is an old commercial town, and is cosmopolitan. The major tribes of the town are Manga and Hausa.

The results of all the cerebrospinal fluid (CSF) specimens obtained from children during the period of the meningococcal epidemic (January to May 2009) were retrieved from the register of the microbiology department and retrospectively studied. The name, hospital number, age, sex, date of analysis, Gram stain, Culture, antibiotic sensitivity and resistance of the isolates were extracted and analysed.

**RESULTS**

A total of 110 CSF samples from children aged 2 months to 13 years were analysed. Gram stain was positive in 54(49.1%) and negative in 56(50.9%) of the 110 CSF samples respectively.

Thirty-two (59.3%) of the 54 positive Gram stain yielded bacterial isolates on culture. There was no isolate out of the 56 negative Gram stain. The isolates (Table I) were 25 (78.1%) *Neisseria meningitidis* (*N. meningitidis*), 4 (12.5%) *Streptococcus pneumoniae* (*Strep pneum*), 2 (6.3%) coliforms, and 1 (3.1%) *Staphylococcus aureus* (*Staph aureus*).

Among the 25 isolates of *N. meningitidis*, there were 15 males and 10 females, with a sex ratio of 1.5: 1. Twelve (48%) of the 25 meningococcal isolates were from children < 60 months, with the youngest aged 2 months, and 13(52%) were from children > 60 months old, the oldest 154 months (Table I).

**Figure 1**

Table I. Age group and bacterial isolates of CSF

Age (months)	Bacterial isolates				Total
	<i>N. meningitidis</i>	<i>S. pneum</i>	<i>S. aureus</i>	<i>Coliforms</i>	
2 – 12	4	0	0	0	4
13 -30	6	1	0	0	7
31 – 60	2	0	1	1	4
61 – 154	13	3	0	1	17
<b>Total</b>	<b>25</b>	<b>4</b>	<b>1</b>	<b>2</b>	<b>32</b>

The sensitivity of the meningococcal isolates tested against ceftriaxone, chloramphenicol, and penicillin was 100%, 92.3%, and 50% respectively. Twenty (95.2%) of the 21

isolates tested against ciprofloxacin were also sensitive, while only 5 (38.5%) of 13 isolates and 4 (36.4%) of 11 isolates tested were sensitive to ampicillin and amoxicillin respectively. All 3(100%) isolates tested against cefuroxime were sensitive. Resistance to co-trimoxazole was 83.3% (5/6) and to genticin 33.8% (5/16). No single antibiotic had all the 25 isolates of the meningococcal organism tested against. The antibiotic sensitivity and resistance patterns of the meningococcal isolates are shown in Table II.

**Figure 2**

Table II. Antibiotic susceptibility pattern of *N meningitidis* isolates

Antibiotic	Sensitivity (%)	Resistance (%)	NT*
Ceftriaxone	14 (100)	0 (0)	11
Cefuroxime	3 (100)	0 (0)	22
Ciprofloxacin	20 (95.2)	1 (4.8)	4
Chloramphenicol	12 (92.3)	1 (7.7)	12
Genticin	16 (76.2)	5 (23.8)	4
Penicillin	1 (50.0)	1 (50.0)	23
Ampicillin	5 (38.5)	8 (61.5)	12
Amoxicillin	4 (36.4)	7 (63.6)	14
Co-trimoxazole	1 (16.7)	5 (83.3)	19

\*NT= Not tested

**DISCUSSION**

A changing pattern of meningococcal meningitis, the epidemiological and antibiotic susceptibility pattern, has been reported in several studies.<sup>1, 3-6, 9</sup> The occurrence of this epidemic during the hot, dry season months of January to May, and ending just before the onset of the rains, is in keeping with an established disease pattern, as earlier reported.<sup>1, 3, 4, 6</sup> It has been documented<sup>1,7</sup> that, pathogens other than *N meningitidis* cause meningitis during meningococcal epidemics, as was seen in this study.

Epidemics of meningococcal disease affects mainly older children, between 5-15 years and young adults.<sup>1,3</sup> Nearly half (48%) the population of cases seen in this study were < 60 months, the youngest being 2 months old; a finding similar to that of other workers.<sup>4,6</sup> The definitive reason for such young age involvement is not known, reasons such as decreasing duration of breastfeeding in Africans, in mimicry of western culture, with consequent loss of protection,<sup>4</sup> virulence of the organism,<sup>1,3</sup> and poor socio-economic status<sup>6</sup> have been speculated.

A male female ratio of 1.5:1 seen in this study is consistent with previous findings.<sup>3,4,6,9</sup> The increased interaction of

males within the communities is thought to explain the preponderance of males in the epidemic.<sup>4</sup>

Management of meningococcal disease in Africa has evolved from no effective treatment, prior to 1938<sup>1</sup>, to the current use of single intramuscular oily chloramphenicol and ceftriaxone during epidemics as advocated by WHO.<sup>7</sup> Penicillins, singly or in combination with chloramphenicol have also been used in industrialised world<sup>1</sup> and in the developing countries<sup>10,11</sup>, to treat meningococcal disease effectively.

Emergence of resistant strains of meningococcal organisms to conventional antimicrobials such as chloramphenicol<sup>5</sup> and penicillins<sup>6,9,13</sup> have been reported and have raised concern for spread of the resistance with resultant complications especially in the developing countries where the first line ceftriaxone are not readily available or affordable.

All the 14 N. meningitides isolates were sensitive to ceftriaxone (100%), a finding in agreement with previous studies.<sup>6,9,12,13</sup> Twelve (92.3%) out of the 13 isolates of N. meningitides tested against chloramphenicol, were sensitive, similar to other studies the sub-region.<sup>6,9,10,12,13</sup> Even though the number of isolates tested against penicillins is too small to draw any conclusions, the pattern of resistance seen in this study is in keeping with previous reports by other workers.<sup>6,9,10,13</sup>

Of the 21 N. meningitides isolates, 95.2% were sensitive to ciprofloxacin, although this drug is not routinely recommended for use in children. Sensitivity pattern of other antimicrobials are shown in table 11.

In conclusion, the sensitivity of the meningococcal organism to ceftriaxone (100%) and chloramphenicol (92.3%) in this study is in support of their use as first-line antibiotics in the treatment of epidemic meningococcal meningitis as advocated by the WHO.<sup>7</sup>

The high sensitivity of the N. meningitides pathogens to

ciprofloxacin (95.2%) needs further evaluation. The limitation of small number of isolates tested against various antibiotics is acknowledged and therefore recommendation for larger studies made.

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