Pyogenic Meningitis in Ilesa, Nigeria

T.A. Ogunlesi, J.A.O. Okeniyi and O.A. Oyelami

From the Department of Pediatrics, Wesley Guild Hospital, Ilesa, Osun State, Nigeria.

Correspondence to: Dr. T.A Ogunlesi, Wesley Guild Hospital, P.M.B 5011, Ilesa, Nigeria. E-mail: tinuade_ogunlesi@yahoo.co.uk, togunlesi@hotmail.com

Manuscript received: November 24, 2004, Initial review completed: February 3, 2005; Revision accepted: March 15, 2005.

This study was conducted in 124 children with meningitis to review the etiology, antimicrobial susceptibility and outcome of disease in a Nigerian tertiary health facility. Of these, 97 (78.27%) were culture positive; in the rest 27(21.8%), diagnosis was based on Gram staining of the CSF. Streptococcus pneumoniae, Haemophilus influenzae, Neisseria meningitidis, Staphylococcus aureus and Escherichia coli were isolated in 33.9%, 33.9%, 5.6%, 2.4% and 2.4% samples respectively. All the isolates had 100% sensitivity to both ceftriaxone and ciprofloxacin while the sensitivities to penicillin and ampicillin were remarkably low. The mortality was 33/ 124 (26.6%) while 16/ 91 (17.6%) of the survivors had various neurologic sequelae.

Keywords: *Childhood, meningitis, Nigeria, pyogenic.*

PYOGENIC meningitis is an acute bacterial infection of the central nervous system which is associated with remarkable mortality(1). It accounted for 2.7% of infantile deaths among hospitalised children in Ilorin(2) and 3.4% of post-neonatal deaths in a Sokoto hospital(3) both in Nigeria. Although, several studies have described the epidemiology of childhood meningitis in Nigeria(4,5) the antimicrobial susceptibility of the bacterial isolates is not routinely audited in most centers. Yet, such surveillance is imperative for appropriate case management in meningitis. Therefore, this study was conducted to review the etiology and the antimicrobial susceptibility of the pathogens in childhood pyogenic meningitis in a Nigerian tertiary health facility.

Subjects and Methods

This is a descriptive retrospective study carried out at the Wesley Guild Hospital, Ilesa, south-western Nigeria. The hospital records of children in the post-neonatal age admitted with the diagnosis of meningitis between January, 1998 and December, 2003 were analysed. Included in the study were children in whom the diagnosis of meningitis was made based on either positive cerebrospinal fluid (CSF) bacterial culture or Gram stain reaction in addition to the presence of more than 5 pus cells/mm^3, CSF with polymorphonuclear pleocytosis, CSF protein above 40 mg/dL and CSF glucose less than two-third of concomitantly determined blood glucose(6). Children with clinical and biochemical features of meningitis but without microscopic evidences and those with tuberculous meningitis were excluded.

All the children received intravenous dexamethasone before the commencement of antibiotics and this was given for 72 hours(7). Prior to the availability of bacterial culture reports, children younger than 5 years were treated with a combination of parenteral ampicillin and chloramphenicol while those aged 5 years and above had penicillin G and chloramphenicol combination. Thereafter, ampicillin, chloramphenicol or ceftriaxone

were used depending on the sensitivity report(6). Other supportive measures were given, as and when desired. Survivors were followed up in the Speciality Clinic. The records of the follow-up visits were reviewed during this study.

Results

Age, sex and seasonal distribution

A total of 7803 children were admitted during the study period. Pyogenic meningitis was microscopically confirmed among 124 (1.6%) children aged between 2 months and 14 years. Forty eight (38.7%), 44 (35.5%) and 32 (25.8%) were infants, pre-school aged and school-aged respectively. There were 88 males and 36 females. Cumulative monthly distribution of the cases showed that 90 (72.6%) and 34 (27.4%) children were admitted between October and March (dry season) and between April and September (rainy season) respectively.

Clinical and laboratory features

The duration of illness prior to presentation varied between 1 and 21 days with the mean of 4.9 (4.2) days. Fifty-eight (46.8%) patients took various medications including antibiotics prior to presentation. Using the NCHS chart(8), the weight for age of 48 (38.7%) and 45 (36.3%) children fell below the 50th centile and the 5th centile respectively. Co-morbidities like pneumonia, sickle cell disease, periorbital cellulitis and arthritis were also present among 28 (22.6%), 12 (9.7%), 4 (3.2%) and 2 (1.6%) children respectively.

Table I shows the clinical and laboratory features of the patients. The mean duration of hospitalisation was higher among the under-fives but without statistical significance (9.4 (6.2) days vs 7.8 (5.4) days; P = 0.197).

Bacteraemia was also more common among the under-fives but without statistical significance ($\chi^2 = 3.8$ and $p = 0.05$). Bacterial pathogens were isolated from 97 (78.2%) CSF samples while 27 (21.8%) CSF samples yielded no growth but demonstrated organisms with similar microscopic characteristics on Gram stain. In the former group, *Streptococcus pneumoniae*, *Hemophilus influenzae* (untyped) and *Neisseria meningitidis* (untyped) constituted 42 (33.8%), 42 (33.8%) and 7 (5.6%) respectively. *Staphylococcus aureus* and *Escherichia coli* also accounted for 3 (2.4%) and 3 (2.4%) respectively. In the latter group, Gram negative Coccobacilli (presumably H. influenzae), Gram negative Diplococci (presumably *Neisseria meningitidis*) and Gram positive Diplococci (presumably *Streptococcus pneumococcus*) formed 6.5%, 2.4% and 12.9% respectively.

Table II shows the antibiotic sensitivity pattern of the three major isolates. The three organisms showed uniformly high sensitivity to ceftriaxone, ciprofloxacin and chloramphenicol while the sensitivity of these organisms to penicillin G and ampicillin were remarkably poor.

Outcome

The mortality among the children with meningitis was 33 (26.6%). The yearly mortality pattern varied between 17.4% and 33.3%. The mortality was lower among the under-fives but without statistical significance {22/92 (23.9%) vs 11/32 (34.4%); $\chi^2 = 1.33$ and $P = 0.25$}. The etiology-specific mortality was 10/42 (23.8%), 8/42 (19.0%), 3/7 (42.9%), 2/3 (66.7%) and 2/3 (66.7%) for *H. influenzae, S. pneumoniae, N. meningitidis, S. aureus* and *E. coli* respectively. The overall case fatality rate of pyogenic meningitis was 33 (26.6%) but was 25/97 (25.8%) and 8/27 (29.6%) among children with and those without CSF bacterial isolates respectively.

TABLE I–*Features of Children with Pyogenic Meningitis.*

Features	Under-5 years (n = 92)	>5 years (n = 32)	P value
*Clinical**			
1. Duration of Illness			
(*a*) 1-3 days	35 (38.1)	22 (68.8)	0.003
(*b*) > 4 days	57 (61.9)	10 (31.2)	
2. Fever	91 (98.9)	27 (84.4)	0.009
3. URTI**	57 (61.9)	6 (18.8)	<0.001
4. Ear discharge	15 (16.3)	5 (15.6)	0.85
5. Seizures	71 (77.2)	28 (87.5)	0.32
6. Coma	58 (63.0)	22 (68.8)	0.56
*Laboratory****			
7. Hematocrit < 20%	20/92 (21.7)	1/ 32 (3.1)	0.014
8. RBG^{+} < 2.2 mmol/ L	37/ 53 (69.8)	8/ 22 (36.4)	0.007
9. Positive CSF^{++} Gram Stain only	22/ 92 (23.9)	5/ 32 (15.6)	
10. Positive CSF culture	70/ 92 (76.1)	27/ 32 (84.4)	
11. Bacteremia	40/ 64 (62.5)	8/ 21 (38.1)	0.050

* Figures in parentheses are percentages of the total 'n' in each column.
** Upper Respiratory Tract Infections
*** Figures in parentheses are percentages of the total indicated
\+ Random Blood Glucose ; ++ Cerebrospinal Fluid

On discharge, 16/91 (17.6%) had various gross neurologic deficits including generalized hypertonia, hemiparesis, facial nerve palsy, impaired speech and seizure disorders. Out of the 91 survivors, 50 (54.9%) did not attend follow-up clinic while the highest attendance rate (4 to 8 times) was found among children who had seizure disorder as the major sequelae.

Discussion

The incidence of meningitis in this study is lower than 3.5% reported from Maiduguri(5) which, lies in the meningitis belt of Sub-Saharan Africa. The overall case fatality rate in this study was similar to 26.1% reported from Sagamu(4) but higher than 18.9% reported from Malaysia(9). The annual case fatality rates in this study did not change significantly over the period studied. This may be due to the dearth of advanced life support facilities.

The incidence of significant sequelae to meningitis in this study was lower than 23.5% reported from Sagamu.(4) The difference may be due to the high default rate in our patients. The apparent rarity of hearing deficits in our patients may be attributed to the non-availability of facilities for Evoked Response Audiometry as our assessment of auditory functions was limited to less-efficient bedside clinical methods.

There was no major difference in the spectrum of bacterial etiologies of meningitis from what was previously known(4,5,10).

TABLE II-*In-vitro Antibiotic Sensitivity of Bacterial Isolates in Meningitis.*

Antibiotics	*Hemophilus influenzae*		*Streptococcus pneumonia*		*Neisseria meningitidis*	
	No. of isolates tested	Sensitivity (%)	No. of isolates tested	Sensitivity (%)	No. of isolates tested	Sensitivity (%)
Chloramphenicol	41	32 (95.1)	42	39 (92.9)	6	5 (83.3)
Penicillin G	33	14 (42.2)	36	23 (63.9)	7	5 (71.4)
Ampicillin	42	29 (69.0)	42	32 (76.2)	7	5 (71.4)
Ceftriaxone	34	34 (100.0)	33	33 (100.0)	5	5 (100.0)
Ciprofloxacin	31	31 (100.0)	31	31(100.0)	6	6 (100.0)

There was no campaign for anti-meningococcal vaccination during the period as to have influenced the incidence of meningococcal meningitis in this study. *Staphylococcus aureus* and *E. coli* had been reported as uncommon etiology of post-neonatal pyogenic meningitis in Nigeria(5). No obvious predisposing factors to such uncommon etiology of childhood meningitis were found. Mortality was also highest in children with these unusual etiology probably because the drugs used prior to the availability of laboratory reports were ineffective. However, mortality was unusually low among cases of pneumococcal meningitis for unknown reasons.

The high incidence of sterile CSF may be due to pre-presentation antibiotic use as access to drugs, prescribed or otherwise is unrestricted in Nigeria(11). This 'culture-negative CSF' debacle can be readily overcome if newer methods of diagnoses(12), which do not necessarily require the presence of live pathogens such as latex agglutination and polymerase chain reaction are incorporated into medical laboratory practice in the region. This problem of antibiotic misuse may lend credence to the increasing resistance of the etiology to the common anti-meningitic drugs *i.e.*, ampicillin, penicillin and chloramphenicol, in Nigeria(5). The high resistance of the pathogens to penicillin and ampicillin and the sensitivity to Chloramphenicol was not strange in Nigeria(5,13).

Chloramphenicol appears to be the only one of the three traditional drugs which can safely be used for empirical treatment of meningitis without significant risk of treatment failure. In our experience, there had been no major untoward effect of chloramphenicol use in children. Ciprofloxacin achieves good CSF penetration in meningitis(14) and this had been shown to translate to less mortality among meningitic children(15). On the other hand, the major problem with ceftriaxone and ciprofloxacin is the high cost which technically reduces their usefulness in the developing world where most patients are poor.

Acknowledgement

We wish to thank the entire staff of the Medical Records Department of the Wesley Guild Hospital, Ilesa for their assistance.

Contributors: JAOO drafted the paper. OAO critically revised the manuscript. All three authors approved the final draft.

Funding: None.

Competing interests: None stated.

Key Messages

- Bacterial causes of meningitis are remarkably resistant to the traditional anti-meningitic antibiotics like Penicillin G and Ampicillin in Ilesa, Nigeria.
- Ceftriaxone is recommended as the first line drug for pyogenic meningitis in Ilesa, Nigeria but Chloramphenicol may be substituted.

REFERENCES

1. Prober CG. Central Nervous System Infections. In: Behrman RE, Kliegman RM and Jenson HB (eds.) Nelson's Textbook of Pediatrics, 17th Edition, Pennsylvania: WB Saunders Company; 2004; 2038-2044.
2. Fagbule D, Joiner KT. Pattern of childhood mortality at the University of Ilorin Teaching Hospital. Nig J Paediatr 1987; 4: 1 - 5.
3. Ibrahim M, Udomah MG, Abduwahab I. Infant mortality at the Usmanu Danfodiyo University Teaching Hospital, Sokoto. Nig J Paediatr 1993; 20: 17-20.
4. Olanrewaju DM, Olusanya O, Laditan AA. Acute bacterial Meningitis in children. West Afr J Med 1991; 10: 405-411.
5. Akpede GO, Adeyemi O, Abba AA, Sykes RM. Pattern and antibiotic susceptibility of bacteria in pyogenic meningitis in a children's emergency room population in Maiduguri, Nigeria, 1988 - 1992. Acta Paediatr 1994; 83: 719-723.
6. Klein JO, Feigin RD, McCracken GH. Report of the Task Force on Diagnosis and Management of Meningitis. Pediatrics 1986; 78: Suppl 959-981
7. Heyderman RS, Klein NJ, Levin M. Management of bacterial meningitis. Current Pediatr 1993; 3: 15-19
8. National Centre for Health Statistics. Growth Charts. US Department of Health Education and Welfare, Public Health Service, Health Resources Administration, Rockville MD 1976; HRA 76: 1120.
9. Choo KE, Ariffin WA, Ahmad T, Lim WL, Gururaj AK. Pyogenic meningitis in hospitalised children in Kelantan, Malaysia. Ann Trop Pediatr 1990; 10: 89 - 98.
10. Johnson WB, Adedoyin OT, Abdulkarim AA, Olanrewaju WI. Bacterial pathogens and outcome determinants of childhood pyogenic meningitis in Ilorin, Nigeria. Afr J Med Med Sci 2001; 30: 295-303.
11. Osinusi K, Oyejide CO. Child care practices with respect to acute respiratory tract infections in a poor urban community in Nigeria. Rev Infect Dis 1990; 12: 1039-1041.
12. Zaidi AKM, Goldman DA. Diagnostic Microbiology. *In:* Behrman RE, Kliegman RM and Jenson HB (eds.) Nelson's Textbook of Pediatrics, 17th Edition, Pennsylvania: WB Saunders Company2004, p. 835-837.
13. Akpede GO, Dawodu SO, Umuoffia ME. Response to antimicrobial therapy in childhood bacterial meningitis in tropical Africa: report of a bi-centre experience in Nigeria, 1993 - 1998. Ann Trop Paediatr 1999; 19: 237-243.
14. Green SD, Ilunga F, Cheesbrough JS, Tillotson GS, Hichens M, Felmingham D. The treatment of neonatal meningitis due to Gram-negative bacilli with ciprofloxacin: Evidence of satisfactory penetration into CSF. J Infect 1993; 26: 253-256.
15. Kiwanuka JP, Mwanga J. Childhood bacterial meningitis in Mbarara Hospital, Uganda: antimicrobial susceptibility and outcome of treatment. Afr Health Sci 2001; 1: 9-11.