

Predominant Bacterial Agents of Childhood Meningitis in Calabar

AA ASINDI*, CE EFFIONG** AND KT UDO†

Summary

Asindi AA, Effiong CE and Udo KT. **Predominant Bacterial Agents of Childhood Meningitis in Calabar.** *Nigerian Journal of Paediatrics* 1986; 13:41. A review of 51 cases of bacterial meningitis in neonates and children up to the age of 12 years admitted to the University of Calabar Teaching Hospital, Calabar, during a 34-month period, has shown that the predominant organisms in the newborn period were *Pseudomonas aeruginosa* (46%), *coliforms* (27%) and *Strept pneumoniae* (19%). Between the ages of one month and 2 years, the common organisms isolated were *Strept pneumoniae* (47%) and *H influenzae* (32%). However, because of the small numbers involved, it was not possible to define the predominant bacterial patterns at different ages above two years. Based on the results of sensitivity tests, it is recommended that initial antibiotic therapy should consist of a combination of ampicillin and gentamicin in neonatal meningitis while ampicillin in high doses or a combination of penicillin and chloramphenicol should be used in children above the age of one month.

Introduction

CHILDHOOD meningitis, unless promptly diagnosed and appropriately treated, is associated with high mortality and morbidity. To obtain the optimal results in the treatment of meningitis, organisms prevalent in the locality should be identified. Available reports suggest that causative organisms vary from one place to another

and from time to time in any particular locality.¹⁻³ This retrospective study was undertaken to determine the causative organisms in infants and children admitted with pyogenic meningitis to the University of Calabar Teaching Hospital (UCTH), Calabar, and the sensitivity pattern of such organisms to antibiotics, with a view to formulating an antibiotic policy in the treatment of meningitis in the institution and probably, the locality.

University of Calabar Teaching Hospital, Calabar

Department of Paediatrics

* Senior Lecturer

** Professor

Department of Medical Microbiology and Parasitology

† Chief Medical Laboratory Scientist

Materials and Methods

Records of all infants and children whose cerebrospinal fluid (CSF) specimens were examined during a period of 34 months (December 1981-September 1984), were reviewed. Infants with

meningomyelocele were excluded. Information obtained from the records included age, sex, date of admission, organisms isolated from the CSF, results of sensitivity tests and the outcome of treatment in each case. The CSF was cultured, using well-established standard methods; each specimen was treated within 30 minutes of arrival at the laboratory.

During the study period, the following treatment regimens were practised. A combination of gentamicin (5 mg/kg/day) and ampicillin (100 mg/kg/day) was given parenterally to patients under 6 weeks of age. Children above 6 weeks were initially given ampicillin (300-400 mg/kg/day). The antibiotic regimen was modified when culture and sensitivity results indicated the need for a change. Treatment was continued for a minimum of ten days.

During the 34-month period, a total of 325 children (180 males and 145 females) had lumbar punctures done. These were made up of 118 neonates and 207 children aged between one month and 12 years. Indications for spinal tap in the neonates included suspicion of sepsis or meningitis such as poor feeding, lethargy, vomiting, abnormal temperatures, apnoeic attacks, colour changes and convulsion. In older children, lumbar puncture was indicated by irritability, neck rigidity and convulsions.

Results

Fifty-one (15.7%) of the 325 children on whom lumbar punctures were performed had bacteriologically proven meningitis. There were 29 males and 22 females, a male to female ratio of 1.3:1. Twenty-six (51%) of the patients were neonates and 25 (49%) were children whose ages ranged from one month to 12 years. Of the 26 neonates, 17 were admitted from outside the hospital while the remaining 9 were delivered at the Maternity Annex of UCTH.

Aetiological Agents

Of the 51 organisms isolated, 32 (62.7%) were gram-negative and 19 (37.3%) gram-positive bacteria (Table I). The gram-negative organisms

TABLE I

Causative Organisms in 51 Cases of Meningitis

Organisms	No of Isolates
<i>Gram-negative</i>	32 (62.7)*
<i>Pseudomonas aeruginosa</i>	13 (40.6)
Coliforms	8 (25.0)
<i>Haemophilus influenzae</i>	6 (18.8)
<i>N Meningitides</i>	5 (15.6)
<i>Gram-positive</i>	19 (37.3)
<i>Strept pneumoniae</i>	16 (84.2)
<i>Staphylococcus aureus</i>	2 (10.5)
Non-haemolytic <i>Strept</i>	1 (5.3)
Total	51 (100.0)

*Percentages in brackets.

consisted of *Pseudomonas aeruginosa* (13), coliforms (8), *H influenzae* (6) and *N meningitides* (5). The gram-positive organisms were *Streptococcus* (17) and *Staphylococcus aureus* (2).

Among the neonates, there were 21 (80.8%) gram-negative and 5 (19.2%) gram-positive isolates. *Pseudomonas aeruginosa* was identified in 12 (57.1%), coliforms in 7 (33.3%) and *N meningitides* in 2 (9.6%) of the 21 newborns with gram-negative organisms (Table II). Due to lack of facilities, it was not possible to identify the species of the coliform organisms. *Streptococcus pneumoniae* was the only gram-positive organism found in this age group and was isolated from 5 of the 26 patients.

Of the 19 cases of meningitis in those aged 1-24 months, *Streptococcus pneumoniae*, *H influenzae* and *N meningitides* were cultured in 9, 6 and 2 specimens respectively, while coliforms and *Pseudomonas aeruginosa* were isolated in one case each. Above the age of 2 years, there were 6 isolates, namely *Streptococcus pneumoniae* (2) *Staph aureus* (2), non-haemolytic strept (1) and *N meningitides* (1).

Sensitivity patterns

The in-vitro antibiotic sensitivity pattern of the bacteria isolated is shown in Table III. All th

TABLE II
Age Distribution and Causative Organisms in 51 Cases of Meningitis

Age	Organisms						Total No of Cases
	Pseud	Colm	H inf	N meningitides	Strept	Staph	
0 — 4 wks	12	7	0	2	5	0	26
5 wks— 12 mon	0	1	3	1	5	0	10
13 — 24 mon	1	0	3	1	4	0	9
25 — 36* mon	0	0	0	0	0	1	1
Above 60* mon	0	0	0	1	3	1	5
Total	13	8	6	5	17	2	51

Colm = Coliforms

H inf = H influenzae

Staph = Staphylococcus aureus

Pseud = Pseudomonas aeruginosa

Strept = Streptococcus

*There were no cases of meningitis in the age group, 37–60 months.

TABLE III
Sensitivity Pattern of the Organisms isolated in 51 Cases of Meningitis

Organism	No of Cases	Antibiotics Tested			
		Pn	Gent	Amp	Chlor
Streptococci	17	15/16	Nt	17/17	2/6
Pseudomonas	13	Nt	11/11	0/4	Nt
Coliforms	8	Nt	7/7	0/4	7/7
H influenzae	6	2/6	Nt	6/6	6/6
N Meningitides	5	1/4	2/2	3/4	3/3
Staphylococci	2	1/2	2/2	1/2	Nt

Pn = Penicillin Gent = Gentamicin Amp = Ampicillin

Chlor = Chloramphenicol Nt = Not tested

The nominators and denominators indicate respectively, the number of sensitive organisms and those tested against any particular antibiotic.

pseudomonas and coliforms tested were sensitive to gentamicin and resistant to ampicillin. All the 17 isolates of streptococci tested were sensitive to ampicillin while 15 (94%) of 16 tested against penicillin were also sensitive. The *non-haemolytic streptococcus* isolated in one case was sensitive to ampicillin but resistant to penicillin. All the 6 isolates of *H influenzae* were sensitive to both ampicillin and chloramphenicol but only 2 (33.3%) out of 6 were sensitive to penicillin. Not all the 5 isolates of *N meningitides* were tested against any one antibiotic agent, but it is noteworthy that all those tested against gentamicin (2) and chloramphenicol (3) were sensitive while only 1 (25%) of 4 was sensitive to penicillin.

Immediate Outcome

It was possible to ascertain the immediate outcome in 23 of the 26 neonates; the remaining 3 were discharged against medical advice. Of these 23 neonates, 17 (74%) were discharged home while 6 (26%) died. One of the infants discharged had developed hydrocephalus in the hospital. Of the 6 dead neonates, 2 each had *Pseudomonas aeruginosa* and *Streptococcus pneumoniae* meningitis while there was one case each with coliform organisms and *N meningitides*. One (4%) of 25 older children, a 12-year old female with *Streptococcus pneumoniae* meningitis, also died in this series. As records of outpatient follow-up could not be traced, it was not possible to determine what happened to the children after discharge.

Discussion

The present study has shown that *Pseudomonas aeruginosa*, coliforms and *Streptococcus pneumoniae* were the predominant bacterial causative agents in neonatal meningitis as seen in the UCTH. These findings contrast with recent reports from Ibadan³ and Benin City,⁴ which showed that

E coli and *Klebsiella species* respectively, were the dominant gram-negative bacterial agents causing meningitis in the neonate. In the series in Ibadan,³ the major gram-positive organism was *Streptococcus pneumoniae* in contrast to the report from Benin City where *Staphylococcus aureus* predominated.⁴ In Europe⁵ and the United States of America,^{6,7} however, group B *streptococcus* is the leading cause of meningitis in the newborn.

In children aged one month and above, *Streptococcus pneumoniae* and *H influenzae* were the major bacterial agents identified. These findings are similar to reports from Ibadan^{8,9} but contrast with those from the USA¹⁰ and Britain¹¹ where *H influenzae* and *N meningitides* predominate in this age group respectively. In the present study, meningitis was mainly a disease of infancy and children aged two years and under. Only 12 per cent of children with meningitis were above 2 years old.

Antibiotic sensitivity pattern in this study suggests the use of gentamicin and ampicillin in the treatment of neonatal meningitis. The finding that the isolated gram-negative organisms and *Streptococcus pneumoniae* were completely sensitive to gentamicin and ampicillin respectively, makes their continued use as the initial antibiotic combination, a wise choice, while awaiting the results of culture and sensitivity tests in neonatal meningitis in the UCTH and probably in Calabar as a whole. Similarly, in children aged one month and above, where the predominant organisms were *Streptococcus pneumoniae* and *H influenzae*, the use of ampicillin in high doses or a combination of penicillin and chloramphenicol, as routine therapy particularly where facilities for sensitivity testing are not available, is indicated. The paucity of the number of cases involved in the present study makes more valid conclusions rather difficult. A prospective study involving many more cases of bacterial meningitis and, if possible, many health institutions, is indicated for more meaningful conclusion to be made and policies decided.

Acknowledgements

We are grateful to all the medical and nursing staff of the Department of Paediatrics for their care of the patients in this study; to the staff of the Department of Medical Microbiology for laboratory services and to Mr AM Udia for secretarial services.

References

1. McGraken CH Jr and Shinefield HR. Changes in the pattern of neonatal septicaemia and meningitis *Amer J Dis Child* 1966; **112**: 33-9.
2. Bhushan V and Chintu C. Changing pattern of pyogenic meningitis in Lusaka. *E Afr Med J* 1979; **56**: 548-56.
3. Dawodu AH and Ashiru JO. The changing pattern of causative bacterial organisms in neonatal meningitis. *Nig J Paediat* 1983; **10**: 1-5.
4. Longe AC, Omene JA and Okolo AA. Neonatal meningitis in Nigerian infants. *Acta Paediat Scand* 1984; **73**: 477-81.
5. Reid TMS. Emergence of group B streptococcus in obstetric and perinatal infections. *Br Med J* 1973; **11**: 533-5.
6. McGraken CJ Jr. Bacterial and viral infections of newborn. In: Neonatology, Gordon BA, ed. Philadelphia: JB Lippincott Company, 1981: 728-36.
7. Baker CJ, Berret FF, Gordon RC and Yow MD. Suppurative meningitis due to Streptococci of Lancefield group B: A study of 33 infants. *J Paediat* 1973; **82**: 724-9.
8. Alausa KO and Osoba AO. Aetiology of acute bacterial meningitis in Ibadan. *Nig J Paediat* 1974; **2**: 57-63.
9. Montefiore D, Alausa KO and Sobayo E. Pyogenic meningitis in Ibadan, Nigeria: A 15-month prospective study. *Scand J Infect Dis* 1978; **10**: 113-7.
10. Report of the Committee of Infectious Diseases: Haemophilus influenzae infections. *Am Assoc Paediat*, 19th Ed. Evaston III 1982: 105-7.
11. Hutchison JH. Practical Paediatric Problems. London: Lloyd Luke, 1980: 486-526.

Accepted 4 October 1985