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Bacterial Meningitis in Infancy and Childhood in Lusaka

(One Year Prospective Sturdy)

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SUMMARY

In approximately 10,000 admissions in a 12 months period, at University Teaching Hospital, Lusaka 85 cases of meningitis were recorded. The signs and symptoms in these patients do not greatly differ from other similar studies in Africa. The commonest organism isolated was pneumococcus. There was high mortality rate which was to a large extent due to parents not bringing their children to hospital early enough for medical treatment to be instituted. This is borne out by the fact that 50% of the children with meningitis died within the first 24 hours. The C.S.F. protein and peripheral white blood count may be of prognostic value. Spasticity, cranial nerve palsises hydrocephalus and subdural effusion were the commonest complications.

INTRODUCTION

Bacterial Meningitis in children is a very common problem and has a very poor prognosis particularly in the developing countries. A prospective study of bacterial meningitis was carried out between 1st

August 1973 and 31st July 1974 to examine the prevalence and prognostic factors of this illness in children admitted to the University Teaching Hospital.

METHOD

All children under the age of 12 years who were diagnosed by lumbar puncture as having bacterial meningitis between 1st August 1973 and 31st July 1974 were included in the study. All those having meningitis but in whom lumbar puncture was not or could not be performed were excluded from the study. A proforma was constructed in which clinical information, laboratory results, medication and immediate complications were recorded.

Bacteriology

The C.S.F. was received in the laboratory in sterile screw capped Bijou bottles. Every effort was made to see that the specimen reached the laboratory immediately after collection.

In the laboratory a visual check was made for colour, turbidity, presence of deposits or clot and the white blood cell count was determined using a W.B.C. pipette and counting chamber. A differential cell count was also carried out.

Gram stained smears of the C.S.F. were prepared and examined for bacteria and a provisional diagnosis made from their morphology. If necessary an acid fast stain for the tubercle bacilli was also carried out.

The C.S.F. was then plated on chocolate agar and blood agar and incubated overnight in 10% CO_2 at 37°C. The colonies developing on the plates were identified from their morphology and biochemical tests.

RESULTS

85 patients were admitted during this period. The monthly distribution showed a peak during December and January, See Table I. This is during the rainy season in Zambia.

The commonest presenting symptoms were fever (74.1%) cough and signs of upper respiratory tract infection (60%), stiff neck (48.2%), bulging fontanelle (35.3%) convulsions, vomiting and drowsiness 32.9%, 30.5% and 24.7% respectively. See Table II.

The commonest signs were spasticity (75.3%) signs of pneumonia (74.1%), neck rigidity (67.1%), fever (60%), bulging fontanelle (40.5%), Kernig's sign (44.7%). Clinical malnutrition was found only in 10% of the patients. See Table III.

The causative organisms in relation to age and sex are shown in Table IV. The majority of children were below 1 year of age. The male to female ratio was 5.3. The commonest organism was pneumococcus which was isolated in 37% of all the patients with meningitis. This was followed by Haemophilus influenzae 10.7%. Salmonella was isolated in 4.6% of cases. Miscellaneous organisms included double infection with Klebsiella and β-haemolytic Streptococci, Listeria monocytogenes and unidentified coliform orga-

TABLE I

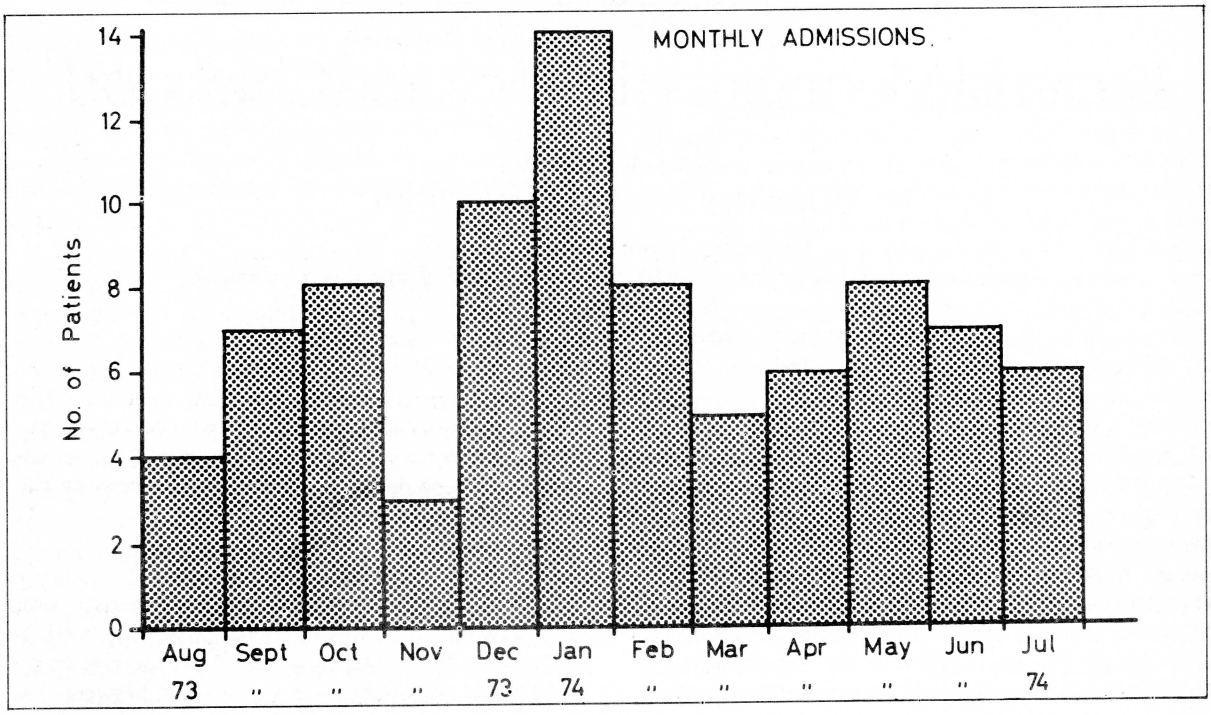


TABLE II

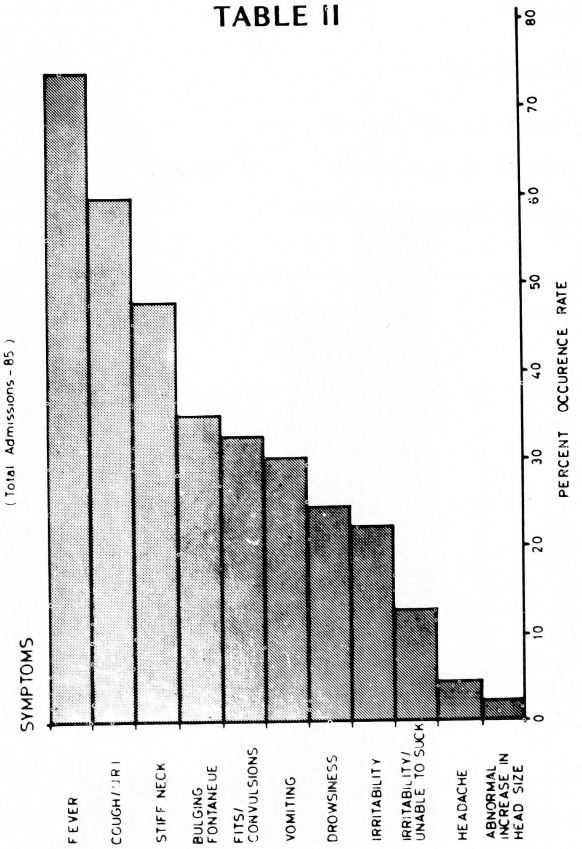


TABLE III

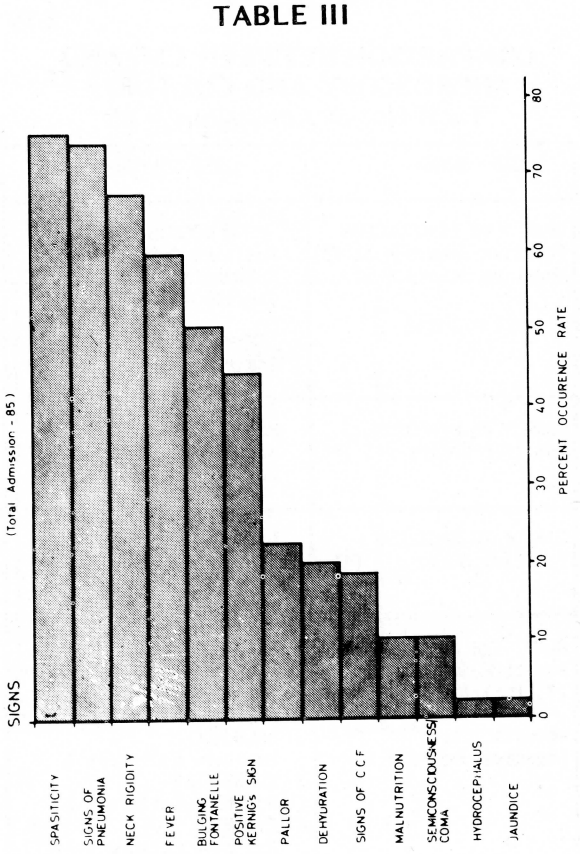


TABLE IV

CSF CULTURES ANALYSIS

Total No. of Admissions += 85
No. of Cultures done = 65

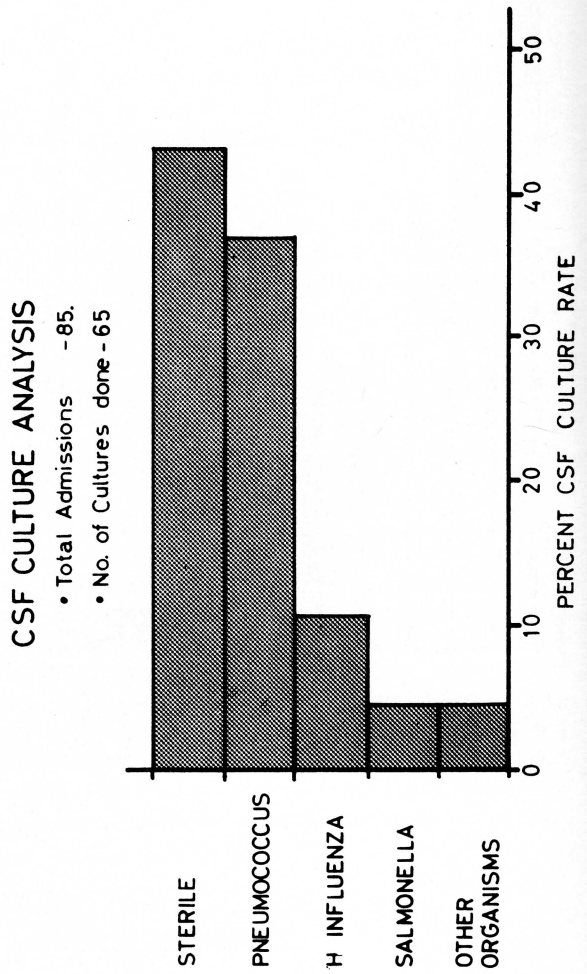
AGE AND SEX	STERILE CULTURE	H. INFLUENZA	PNEUMOCOCCUS	SALMONELLA	OTHER ORGANISMS	TOTAL PER AGE GROUP
0-12 M	15	5	11	1	A. Klebsiella -1 B. L. Monocytogens - 1 C. Coliform - 1	51
MONTHS F	8	1	5	2	A. Streptococcus -1	
13-24 M MONTHS F	2 2	0 1	4 1	0 0	0 0	10
OVER 24 M MONTHS F	1 0	0 0	3 0	0 0	0 0	4
Total No. per Organism	28	7	24	3	3	65
Percent	43.1%	10.7%	39.0%	4.6%	4.6%	100%

TABLE V

COMPARISON BETWEEN CSF AND MICROSCOPY AND CULTURE
Total No. of Admissions = 85

CSF SMEAR	CSF CULTURE
GRAM + VE DIPLOCOCCUS Positive Smears = 31 (*) Negative Smears = 1	1. PNEUMOCOCCUS Positive Culture = 24 Culture not done = 5 Sterile culture = 1 2. STREPTOCOCCUS Positive Culture = 1
GRAM - VE DIPLOCOCCUS Positive Smears = 3 (**)	MENINGOCOCCUS Negative Culture = 1 Culture not done = 1
GRAM + VE BACILLUS Positive Smear = 1 (*)	LISTERIA MONOCYTOGENES Positive Culture = 1 (***)
GRAM - VE BACILLUS Positive Smears = 10 (*) (**) (***) Results lost = 1 Negative Smears = 5	1. H. INFLUENZA Positive Cultures = 7*(**) Negative Culture = 1 Culture not done = 2 2. SALMONELLA Positive Culture = 3 3. KLEBSIELLA Positive Culture = 1 4. E. COLI Positive Culture = 1 (*)

TABLE VI



nisms which constituted 4.6%. There were 65 cultures done and out of these 37 were positive yield of 56.9%. See Tables V and VI.

6 of the 28 cases in whom no organisms were grown, were diagnosed as tuberculous meningitis on the basis of C.S.F. white cell differential count, protein, a Chest X-Ray suggestive of tuberculosis, positive gastric washing for tubercle bacilli and positive Heaf Test. See Table VII.

TABLE VII

TB Meningitis

AGE GROUP	0-12 months	13-24 months	Over 24 months	Total
TB MENING-ITIS	3	2	1	6

Comparison between culture and smear identification of organisms is shown in Table V. In general there were more positive smear than there were positive cultures. Three gram-negative diplococci were seen in the C.S.F. of an infant with meningitis and were thought to be meningococci. The culture grew 4 different organisms which were contaminants. A repeat culture of the C.S.F. of this child grew E. Coli and H. Influenzae.

Table VIII shows incidence of mortality was 41.2%. Not included in the analysis are 4 children, 3

TABLE VIII

MORTALITY ANALYSIS

Total No. of Admissions = 85
Total No. of Deaths = 35
Total mortality rate = 41.2%

Age	Total No. Adm.	Males	Females	No. Dead	Mortality %
0-12 months	63	39	24	24	38.1
13-24 months	14	10	4	6	42.9
over 24 months	8	6	2	5	62.5

TABLE IX

COMPARISON BETWEEN MORTALITY AND HOSPITAL STAY

Total No. of Admissions = 85
Total No. of Deaths = 35

No. of Days of Hospitalisation	0-12 Months	13-24 Months	over 24 months	Total No. Dead	Mortality %
0-1 day	8	5	4	17	50.0%
1-5 days	5	1	-	6	17.6%
over 5 days	10	-	1	11	32.4%

of whom absconded and one died on readmission from measles and congestive cardiac failure. Fifty per cent of the children died within 24 hours of admission in the Hospital See Table IX.

Comparison between mortality, age, and C.S.F. protein was made and this depicted in Table X. Mortality was comparatively high when the protein in the C.S.F. was greater than 100mg%. The figure of 100mg was chosen arbitrarily. Similarly a comparison was made between mortality and peripheral white blood cell count. Mortality was higher in those patients with a white blood cell count below 10,000/cmm.^{3} See Table XI. These figures are however too small to be statistically significant.

The immediate complications are listed in Table XII which shows that the commonest complication was spasticity followed by hydrocephalus and cranial nerve palsies. Subdural effusion was found in 10.9% while recurrent meningitis were the same in two of the cases and the interval between recurrence was longer than 3 months in the two cases and 7 days in the third in whom the culture was sterile on first C.S.F.

Haemoglobin electrophoresis was done in 43

TABLE X

COMPARISON BETWEEN MORTALITY AND CSF PROTEIN RISE

Total No. of Admission = 85
No. of P/s with CSF Protein results = 69

AGE GROUP	CSF PROTEIN 40-100 mg%	NO. DEAD	MORTALITY %	CSF PROTEIN 100 mg%	NO. DEAD	MORTALITY %
0-12 months	29	9	31.0%	22	10	45.5
13-24 months	7	2	29.0%	3	2	66.7
Over 24 months	3	1	33.3%	5	4	80.0

TABLE XI

COMPARISON BETWEEN MORTALITY AND BLOOD WBC

Total No. of Admissions = 85
No. Pt with FBC = 60

AGE GROUP	BLOOD WBC 10,000	NO. DEAD	MORTALITY %	BLOOD WBC 10,000	NO. DEAD	MORTALITY %
0-12 months	13	4	30.7%	35	9	25.7%
13-24 months	3	2	66.7%	6	1	16.7%
over 24 months	2	0	0.0%	1	1	100%

TABLE XII

IMMEDIATE COMPLICATIONS

Total No. of Admissions = 85
No. pts with immediate complications 27

COMPLICATION	0–12 months	12–13 months	Over 24 months	Total	% OCCURRENCE
1. Spasticity	13	4	1	18	39.1
2. Cranial nerve Palsy	5	1	—	6	13.0
3. Hydrocephalus	6	—	—	6	13.0
4. Subdural Effusion	5	—	—	5	10.9
5. Recurrent Meningitis	2	1	—	3	6.5
6. Brain Damage	1	—	1	2	4.3
7. Flaccid Palsy	1	1	—	2	4.3
8. Hyperactivity	2	—	—	2	4.3
9. Deafness				1	2.2
10. Blindness	—	1	—	1	2.2

TABLE XIII

SICKLING TEST RESULTS

Total No. of Admissions = 85
No pts with Sickling Test done = 43

SICKLING TEST AND HB ELECTROPHORESIS	0-12 months	13-24 months	Over 25 months	Total	% OCCURENCE
I. Negative	21	7	2	30	69.8
2. Hb A-S	8	2	1	11	25.6
3. Hb S-S	2	-	-	2	4.6

patients, 30 were negative, 11 had Sickle Cell trait and two were homozygous for Hb. S. See Table XIII.

DISCUSSION

The children's section of the University Teaching Hospital admits approximately 10,000 patients a year. during the period of study there were 85 children 55 were male and 30 females. The preponderance of males over females has been shown by many studies Dekker (1970), Johnston (1970).

The symptoms were non-specific in most cases. The four commonest symptoms were fever, symptoms of respiratory infection, stiff neck and bulging fontanelle. The commonest sign in this study was spasticity which was found in 75% of all patients. 74% had signs of pneumonia. This association between meningitis and pneumonia has been noted by other authors: Dekker, (1970), Seriki (1970), Kendal (1971). Neck rigidity, bulging fontanelle and positive Kernig's sign were seen in 67.1%. 50.5%. 44.7% of the patients respetively. In some of the patients who had dehydration, a bulging fontanelle was not evident on admission but became clinically detectable after rehydration.

Diplococcus pneumoniae accounted for most of the cases of meningitis, 56.9% of all positive cultures. In a study of the aerobic bacterial flora of the throat in the outpatients at the Children's Hospital, pneumocci was isolated in 32% of children under 3 years of age and 15% in the older age group (Khan and Bathirunathan 1975). It would appear that, most probably, the focus of infection in pneumococcal meningitis is the respiratory tract. This is supported by the symptoms and signs of respiratory infection in children with meningitis, Seriki (1970), Kendal (1971) Dekker (1970). This study showed that Haemophilus influenza accounted for only 16.9% of all positive C.S.F. culture as compared to 38.4% in Johnston's (1970) study in the same hospital. Johnston's (1970) work included adults but if only children under two years were considered her figure in this respect rises to 56%. In our study pneumoccoccus is still the most common organism causing meningitis even in children under 2 years. However, the majority of the cases of Haemophilus influenzae meningitis occurred in children under 2 years a finding which is in agreement with that of Johnston (1970). In the study of Khan and Bathirunathan referred to above Haemophilus influenzae was isolated only in 15% of children under 3 years of age and 9% in the older age group. Some uncommon organisms were encountered in this study. Amongst these were 3 cases of Salmonella Meningitis which have been reviewed and reported elsewhere (Chintu and Bathirunathan 1975).

Examination of the CSF by smear yield more positive results than on culture. This is mainly because of the possible use of antibiotics by patients prior to diagnosis which rendered C.S.F. culture negative inspite of positive smear. (The other possible factors are the technique and the experience of the Technician). The yield of 56.9% in this study compares favourably with other studies Dekker (1970) Ogunbi (1970).

A mortality of 41.2% in this study has not changed much from the previous study in this Hospital (Johnston 1970) and are similar to those in Harare Hospital. Rhodesia (Kendal 1971). There are several factors contributing to mortality. One is delay in instituting therapy. Some of our patients had symptoms for several days before seeking hospital medical attention. They often consulted a traditional medicine man prior to coming to hospital. As a result 50% of the patients died within 24 hours. Modern medi-

cine has not completely and fully gained the confidence of all the people in Zambia. This is also reflected in a few patients whose parents absconded with them after a few days of hospitalization. The second reason is that most of our patients had pneumonococcal meningitis and this known to have a high mortality. The third is that although the organisms are sensitive to the antibiotics, these antibiotics may not reach therapeutic concentration in the C.S.F. This is particularly so with Ampicillin which does not cross the healing blood-brain-barrier membrane in adequate therapeutic concentration (Smith 1974).

Prognosis is also poor in under nourished patients with lowered resistance to infection. Malnutrition is among four major reasons for admission to the U.T.H. (viz. Gastroenteritis, respiratory infection, anaemia, and malnutrition). The impaired host defence mechanism in malnutrition could also contribute to a higher incidence of meningitis in this group. However, it was surprising that malnutrition was clinically detectable in only 10% of the patients with meningitis in our study. This is also true in another study conducted at Arthur Davidson Children's Hospital, Ndola, Zambia. (Anand 1975).

In this study either triple therapy (Crystalline Penicillin, Chloramphenical and Sulphonamide) or Ampicillin were used in meningitis other than tuberculous meningitis. There was no difference in terms of therapeutic value over either choice. This finding is similar to Dekker's (1970). In terms of nursing it is easier to administer one drug instead of multiple drugs. However, Ampicillin is expensive as higher doses are needed; also relapses have been observed possibly due to diminishing levels of Ampicillin in the C.S.F. secondary to decreasing meningeal permeability during healing (Smith 1974, Levine et al 1970 Greene 1968).

Our findings are that laboratory results such as C.S.F. protein, and peripheral blood white cell count have prognostic value. C.S.F. protein greater than 100 mg per 100 ml. was associated with higher mortality presumably because, with greater inflammatory process there will be more protein in the C.S.F. In patients with peripheral blood white count less than 10,000 there was higher mortality. This may reflect inability to marshall adequate white cells to combat infection in these patients. The figures are however small to be statistically significant. Although neutropenia was not looked for in this study there may well have been neutropenia in some of these patients. Ezeilo (1971) has found neutropenia in black Africans which he attributes to dietary deficiency.

Follow-up of patients with meningitis was difficult. The default rate was very high. It was therefore difficult to assess long term complications. Accordingly only immediate complication were observed. As in the case of mortality rate some of the complications were due to failure to seek medical advice early enough for medical treatment to be effective. The children with hydrocephalus and subdural effusion had features of mental retardation. The period of observation was too short to make any definite conclusions.

Sickle Cell Anaemia is often associated with a high incidence of pneumococcal infection. In this study 43 patients were tested for Sickle Cells. Two cases were homozygous for Haemoglobin SS while 11 had sickle cell trait. The small number of sickle cell anaemia may be due to introduction of a sickle cell anaemia clinic by one of the authors (C.C) during this period which may have reduced serious infections by prompt treatment. The Sickle Anaemia Clinic has the lowest default rate so that these children were able to receive prompt attention in case of any problems.

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