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Research Article

Bacterial Meningitis in the Paediatric Emergency Department of CHU Gabriel Touré

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Abstract

Introduction: In Mali, despite the introduction of several vaccines as part of the Expanded Programme on Immunisation, hospitalisations for bacterial meningitis in our department remain frequent. The aim of our work was to study the epidemiological and clinical profile of bacterial meningitis in the paediatric emergency department of the CHU-GT. **Patients and Method**: We conducted a prospective, cross-sectional, descriptive study over two years (June 1, 2020 to May 31, 2022) of children aged 1 month to 15 years hospitalised in the paediatric emergency department of CHU Gabriel Touré for bacterial meningitis confirmed by bacteriology and/or cytology. **Results:** The hospital incidence rate was 4.5%. The 1 to 12 months age group was the most represented (45%), with a predominance of males (sex ratio 1.6). We found that 18.3% of our sample had not received any vaccine. Seizures occurred in 92.2% of patients. These were generalised in 66.9% and focal in 33.1%. A pleicytosis greater than 100 leukocytes/mm3 was noted in 85.6%. The most frequent germs were Streptococcus pneumoniae (25.6%) and Haemophilus influenzae b (14.4%). The case fatality rate was 27.2%, with Streptococcus pneumoniae the most lethal germ (30.4%). The clinical sequelae were axial hypotonia (54.6%) and hydrocephalus (20.5%). **Conclusion:** Despite vaccination efforts, streptococcus pneumoniae remains the most common bacterial meningitis germ and the most lethal in children.

Introduction

Every year, meningitis is responsible for a high mortality rate (117,000 deaths worldwide) and serious neurosensory sequelae [1]. In children outside the neonatal period, three bacteria are responsible for most cases of bacterial meningitis. These are Neisseria meningitidis, Streptococcus pneumoniae and Haemophilus influenzae b [2 -6]. A study estimating the global burden of morbidity and mortality due to acute bacterial meningitis in children under 5 years of age showed that, globally, the median incidence of this disease is 34 cases per 100,000 children per year. This incidence varies between regions of the world, ranging from 143.6 per 100,000 children per year in Africa to 16.6 per 100,000 children per year in the Americas. The same study showed that the median case-fatality rate is 14.4%, ranging from 31.3% in the African region to 3.7% in South-East Asia [6]. The epidemiology of bacterial meningitis in children is constantly changing [2]. These changes are the result of several factors, the most important of which is the introduction of vaccines against Haemophilus influenzae serotype b, Streptococcus pneumoniae and Neisseria meningitidis in many countries [2,3] Mali is a West African country in the Lapeyron meningitis belt, and epidemics of meningococcal meningitis are not uncommon [7]. Several vaccines have been introduced in Mali as part of the Expanded Programme on Immunisation (EPI), against Haemophilus influenzae (2005) and pneumococcus (2011). Meningococcal A in 2010[2]. Despite the cascade of vaccines introduced in the expanded vaccination programme, hospital admissions for bacterial meningitis in our department are frequent.

The aim of our work was to study the epidemiological and clinical profile of bacterial meningitis in the paediatric emergency department of the CHU-GT.

Patients and Methods

We conducted a prospective, cross-sectional, descriptive study over two years (1 June 2020 to 31 May 2022) of children aged 1 month to 15 years hospitalised in the paediatric emergency department of CHU Gabriel Touré for bacterial meningitis confirmed by bacteriology and/or cytology. Patients are included on admission after verbal consent from the parent or guardian. Any patient presented with one or more of the clinical signs suggestive of meningitis underwent meticulous questioning, a complete physical examination and a lumbar puncture.

The CSF collected was immediately sent to the CHU Gabriel TOURE laboratory on behalf of the Vaccine Development Centre (CVD). Patients were also given a blood culture to test for bacteria. Data were collected from medical records using a pre-established survey form. The variables studied were epidemiological: age, sex, level of education, residence, and vaccination; clinical: reason for consultation/referral, history, clinical signs (head circumference, neurological signs, etc.); paraclinical: CBC (Cell Blood Count), CSF (Cerebrospinal Fluid Examination), blood cultures, treatment; evolution. The data collected were entered and analysed using SPSS version 22 software. The Chi-square test was used to compare categorical variables. A value of $p<0.05$ was considered statistically significant. Data confidentiality was respected.

Results

1. Socio-demographic characteristics

During our study period, 180 cases of meningitis were included in 3958 hospital admissions, representing a frequency of 4.5%. These included 111 boys (61.7%) and 69 girls (38.3%), with an average age of 6 years and extremes of 01 months and 15 years. The 1-12 months age group was the most represented (48.7%). They came from a low socio-economic background (58.9%). Vaccination according to the EPI was in progress in 48.9% of cases, and 18.3% had not received any vaccine (Table 1).

Characteristics		Effective (n=180)	%
Âge(month)	average	72	
	1-12	81	45
	13-59	49	27,2
	60-180	50	27,8
Sex	Male	111	61,7
	Female	69	38,3
Socio-économiq Level	Défavorable	106	58,9
	Acceptable	23	12,8
	Favorable	51	28,3
Vaccination	Correct and completed	59	32,8
	Correct in progress	88	48,9
	Not vaccinated	33	18,3

Table 1: Epidemiological characteristics.

2. Clinical Features

Fever (98.9%) and altered consciousness (68.9%) were the main reasons for consultation. Patients were seen within 3-7 days in 41.7% of cases, with an average of 7 days and extremes of 2 and 12 days. More than half the patients had a temperature above 39.5°C (52.8%), and 42.8% had moderate or severe acute malnutrition. The main neurological signs were convulsions (92.2%), altered consciousness (68.9%), axial hypotonia (68.9%) and cutaneous hyperaesthesia (53.3%) (Table 2).The convulsions were tonicoclonic (66.9%) and generalised (66.9%). The blood count showed hyperleukocytosis in 97.8%, elevated CRP (98.9%), hypoglycaemia in 28.9%. 57.3% of patients underwent cerebral tomodensitometry, which revealed cortical atrophy (17.8%), hydrocephalus (5%), and subdural haematoma (2.2%).

Reason for consultation	Effective (n=180)	%
Fever	178	98,9
Convulsion	166	92,2
altered consciousness	124	68,9
Difficulty breathing	96	53,3
Headache	20	11,1
Digestive Trouble	16	8,9
Plaintive cries	13	7,2
Refusal to breastfeed	12	6,7

Table 2: Distribution of patients according to the reason for consultation.

In 50.6%, pleicytosis was greater than 100 leukocytes/mm3 (85.6%), and Gram staining was positive in 60% (Table 3). The main germs isolated in the CSF were Streptococcus pneumoniae (25.6%), Haemophilus influenzae b (14.4%), Neisseria meningitidis (10.6%), Escherichia coli (6.7%), Staphylococcus aureus (5.5%), Listeria monocytogenes (4.4%) and Salmonella (1.7%). Streptococcus pneumoniae was common before 1 year of age (71.8%). (Table 4). Blood cultures were positive in 69.9% of cases. The main germs were sensitive to conventional antibiotics. Comorbidities were malaria (42.3%), pneumonia (28.2%), urinary tract infection (11.5%) and malnutrition (6.4%).

CSF cytological and bacteriological examination		Effective (n=180)	%
Aspect	Trouble	91	50,6
	suspicious	56	31,1
	Claer	33	18,3
Cytology	>100 leukocytes/mm^3	154	85,6
	11-100 leukocytes/mm^3	26	14,4
Coloration Gram	Positif	108	60
	Négatif	72	40

Table 3: Distribution of patients according to CSF cytological and bacteriological examination.

Sprouts	Effectif	%
Streptococcus pneumoniae	43	23,9
Haemophilus Influenzae B	26	14,4
Neisseria meningitidis A	19	10,5
Staphylococcus aureus	10	5,6
Escherichia coli	7	3,9
Salmonella	3	1,7
Stérile	72	40
Total	180	100

Table 4: Distribution of patients according to the germs identified in CSF culture.

3. Therapeutic characteristics

Combinations of ceftriaxone + gentamycin (25.6%) and cefotaxime + vancomycin (18.9%) were the most commonly used aetiological treatments. Symptomatic treatments included antipyretics (98.9%), anticonvulsants (92.2%) and corticosteroids (72.2%).

4. Evolution

More than a third of the sample (32.2%) had a treatment duration of 7 to 14 days, with an average of 10 days. The case fatality rate was 27.2%, and was high in patients under 12 months of age (p= 0.00005). Almost a quarter (24.5%) recovered with clinically detectable sequelae (Table 5), these sequelae being dominated by axial hypotonia (54.6%), hydrocephalus (20.5%) and abnormal movements (13.6%) (Table 6).

Immédiate evolution	Effective (n=180)	%
Healing without clinically detectable after-effects	81	45
Healing with clinically detectable after-effects	44	24,5
Lost sight of	4	2,2
Exit against medical advice	2	1,1
Deceased	49	27,2
Total	180	100

Table 5: Distribution of patients according to the reasons of consultation.

Age(month)	Death	
	Effective (n=49)	%
1 – 12	37	75,5
13 – 59	9	18,4
60 -180	3	6,1
Total	49	100

Khi²=134,2 P=0,00005

Table 6: Distribution of patients according to death in relation to age.

Discussion

We included 180 cases of meningitis out of 3958 hospitalisations in our department, representing a frequency of 4.5%. Our frequency is higher than that of other African authors, notably in Tunisia, Kammoun TH et al [8] (1.14%), in Senegal Ba ID [9] (3.45%) and in Mali Maiga et al [10] (1.07%). In contrast, Barry et al [11] in the Republic of Guinea and Essola et al [12] in the Republic of Gabon found a frequency of 13.8% and 7.6% respectively. We can deduce that bacterial meningitis remains a public health problem in our regions.

Children under 12 months of age were the most affected with 45%, followed by those aged 13-59 months with 27.2%. These results confirm those of Maiga et al [10] and Doumbia AK et al [13], who showed that bacterial meningitis affects all age groups, but electively children under 5 years of age, with 41.4%, 63% and 60% of cases respectively. The predominance of the condition in children under 5 years of age may be explained by the immaturity of the immune system, with children's susceptibility to ear, nose and throat infections constituting the gateway for the germs responsible for meningitis.

Most of the patients (58.9%) came from families with a low socio-economic status, and 50.6% had no medical insurance. These results are similar to those of Doumbia A K et al [13] who found 62%. The level of education, lack of employment, low income and parents' lack of affiliation to a health insurance scheme have a negative influence on the care of sick children [13].

We found that 18.3% of our sample had not received any vaccine. Our rate was higher than that of Maiga et al [10] and Coulibaly et al [14], who recorded 12% and 6.8% respectively. According to the literature, vaccination is the best large-scale health success in terms of benefit-risk and a very low cost for the population [5]. COVID 19 had an impact on the entire healthcare system, relegating routine vaccinations to second place, hence the high rate of non-vaccination.The average consultation time was 7 days (extremes 2 and 12 days). This rate is similar to that of Doumbia AK et al [13] who found 7 ± 4.2 days (extremes 2 and 21 days). According to the literature, the prognosis depends on how early the diagnosis is made and the quality of management [15].

Convulsion was observed in 92.2% of patients, was generalised in 66.9% and focal in 33.1%. Our results are comparable to those of Coulibaly A [16] who found 60.9%, 93.8% and 6.2% respectively. These results contrast with the data in the literature [15]. Half of our patients were in stage I coma (50.8%). According to the literature, the risk of death or sequelae is increased if the patient has presented a convulsive state, focal neurological signs or an altered state of consciousness [15, 5].

Axial hypotonia was found in 68.9% of cases. Other signs were stiff neck (35.6%), bulging anterior fontanel (33.3%) and hyperaesthesia of the skin (53.3%). These neurological signs were important signs suggesting a strong suspicion of meningitis and should therefore lead to lumbar puncture. They were consistent with those described in the literature [15,11]. CSF culture enabled us to isolate Streptococcus pneumoniae (25.6%), Haemophilus influenzae b (14.4%) and Neisseria meningitidis (10.6%). Several authors confirm the presence of these three germs [10,11]. The presence of others: Escherichia coli (6.7%), Staphylococcus aureus (5.5%), Listeria monocytogenes (4.4%) and Salmonella (1.7%) was found by Diakité F [17] in 2016. In our study, we found 71.8% Streptococcus pneumoniae, 80.8% Haemophilus influenzae b and 100% Escherichia coli and Listeria monocytogenes in children aged 1 to 12 months. Meningococcus was more frequent in children aged between 13 and 59 months (63.2%). This observation is common to all epidemiological studies of purulent meningitis, notably those of E. Bingen [1] and Tfifha M et al [18] in 2018 in Tunisia.

In order to detect acute complications, cerebral CT scans were performed in 58.3% of patients. Our rate is higher than that of Doumbia A K et al [13] who found 5.8%. It was not carried out systematically, but was indicated in cases of increased head circumference in infants under 2 years of age, impaired consciousness, persistent fever or signs of neurological deficit (persistent convulsive seizures, paralysis, visual impairment). Cerebral atrophy was the most frequently reported complication (17.8%), followed by hydrocephalus (5%), encephalitis (2.2%), subdural haematoma (2.2%) and meningeal haemorrhage (1.1%).

Conclusion

Despite the effectiveness of antibiotics (3rd generation cephalosporins), we observed a recovery rate without sequelae of 45% and a recovery rate with sequelae of 24.5%. The most common sequelae were axial hypotonia (54.6%) and hydrocephalus (20.5%). Other sequelae were abnormal movements (13.6%), deaf-mute (6.8%) and blindness (4.5%), 37% of which were associated with pneumococcus. The proportion of sequelae in all forms of the disease varies between 3% and 15% according to the literature [15,4,5].

The hospital case fatality rate remained high at 27.2%, and pneumococcus was the most lethal germ (30.4%). This observation has been reported by several authors [10, 19], and the long delay in consultation, the young age of our patients and, above all, the virulence of the germ could explain this high lethality associated with pneumococcus.

According to the literature, the main risk factors for death or sequelae are: age less than 2 years, prolonged delay in care, the

existence of a coma during hospitalisation, the need for a stay in intensive care, hypoglycorrhagia, and the absence of corticosteroid therapy [15,5].

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