

Prevalence of Bacterial Meningitis in Children Aged 0 to 14 Years in the Pediatrics Department of Donka National Hospital, Republic of Guinea

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How to cite this paper: Camara, E., Camara, Y., Barry, F., Sodogandji, O.C., Toure, A. and Diaby, A.B. (2025) Prevalence of Bacterial Meningitis in Children Aged 0 to 14 Years in the Pediatrics Department of Donka National Hospital, Republic of Guinea. *Open Journal of Pediatrics*, 15, 1029-1034. <https://doi.org/10.4236/ojped.2025.156097>

Received: August 13, 2025

Accepted: October 27, 2025

Published: October 30, 2025

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Abstract

Introduction: Bacterial meningitis is a global public health problem, with several causative etiological agents that vary by age group and geographical area. The objective of this study was to determine the prevalence and identify bacterial species associated with meningitis in children attending the Pediatric Department of Donka National Hospital. **Materials and Methods:** Our study was cross-sectional, lasting ten (10) months, from January 5 to November 8, 2024. **Results:** The prevalence of meningitis among children admitted to the pediatric department of Donka National Hospital was 20.4%. The predominant age group was over 2 years old and males were the most affected. All samples taken from children were tested for Gram. A positivity of 20.4% was recorded, 76.5% were Gram-positive diplococci and 23.5% Gram-negative bacilli. Following culture, 76.5% of meningitis was due to *Streptococcus pneumoniae* and 23.5% to *Haemophilus influenzae*. Regarding antibiotic resistance, *Haemophilus influenzae* was resistant to Cephalotin, cotrimoxazole and Ticarcillin, while *Streptococcus pneumoniae* was resistant to vancomycin, nalidixic acid, cotrimoxazole and Tetracycline.

Keywords

Prevalence, Bacterial Meningitis, Children Aged 0 - 14 Years

1. Introduction

Bacterial meningitis, an infectious disease characterized by infection and inflam-

mation of the meninges, causes abnormalities in the cerebrospinal fluid (CSF) located in the subarachnoid space from the brain to the spinal cord [1]. It can be fatal in 50% of cases if left untreated. Even when diagnosed early and treated adequately, 8% to 15% of patients die, usually within 24 to 48 hours of symptom onset [2]. In Ivory Coast, approximately 10 million children under 14 years of age are most at risk of bacterial meningitis infections [3]. In Mali in 2018, a hospital frequency of 1.4% of bacterial meningitis in children aged 1 month to 15 years was reported [4]. In 2017 in Guinea, a study carried out in the laboratory of the National Institute of Public Health reported a prevalence of 9% [5]. The general objective of this work was to determine the frequency and identify the bacterial species associated with meningitis in children seen for consultation at the pediatric department of the Donka National Hospital.

2. Materials and Methods

This was a prospective (cross-sectional) study lasting ten (10) months from January 5 to November 8, 2024, carried out in the pediatrics department of the Donka National Hospital and on children aged 0 to 14 years received for consultation in the said department. We had performed lumbar puncture on all the children in whom bacterial meningitis was suspected during the study period. Our variables were epidemiological (age, sex, origin), clinical (reasons for consultation) and biological (gram staining, latex agglutination test, bacterial culture, biochemical identification, antibiotic sensitivity test). The collected data were transcribed onto a model and the calculation of proportions, mean, standard deviation and p-value were carried out using SPSS 21 software. The research protocol was validated by the Chair of Public Health and Pharmaceutical Legislation. The data were collected following informed consent from the parents and used for purely scientific purposes and confidentiality was the principle throughout the work.

3. Results

Out of a total of 500 samples analyzed, 102 were positive, representing 20.4% of meningitis. Nearly half of the children were ≤ 2 years old with a male predominance and a sex ratio = 1.39. The majority of children came from the communes of Conakry. Fever, convulsions and neck stiffness were the most reported reasons for consultation by children with respective frequencies of 90%, 47.2% and 26.0% (Flow chart and **Table 1**). The CSF appearance was clear in 397/500 cases and all cloudy CSF were Gram-positive, followed by purulent ones (**Table 2**). A 100% concordance of Gram and culture results was obtained with 76.5% Gram-positive Diplococci and 23.5% Gram-negative bacilli and in culture, 76.5% of meningitis were caused by *Streptococcus pneumoniae* and 23.5% by *Haemophilus influenzae* (**Table 3**). Regarding antibiotic resistance, *Haemophilus influenzae* was resistant to Cephalotin, cotrimoxazole and Ticarcillin. While *Streptococcus pneumoniae* was resistant to Vancomycin, Nalidixic acid, cotrimoxazole and Tetracycline (**Table 4, Figure 1**).

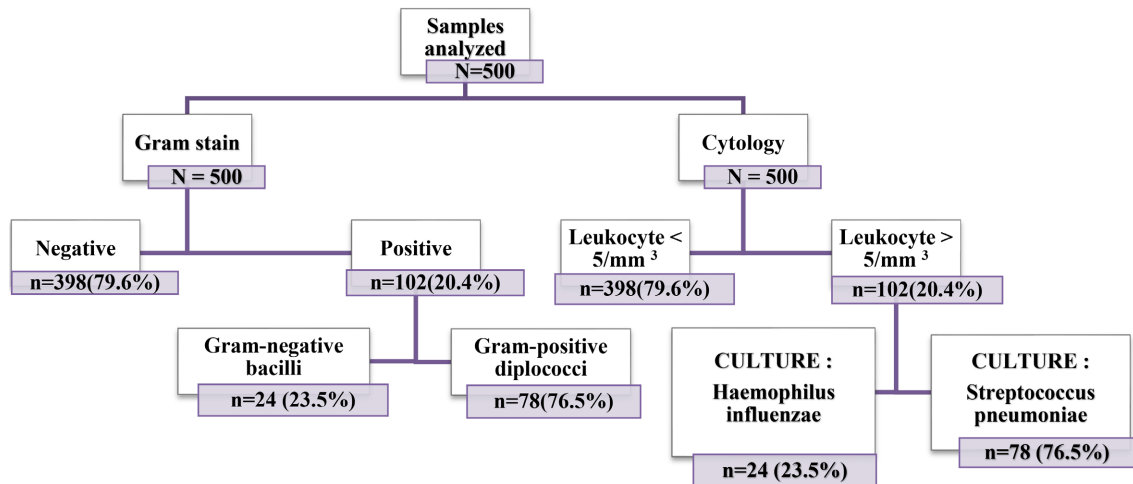


Figure 1. Flow chart includes children aged 0 to 14 years received at the pediatric department of Donka National Hospital from January 5 to November 8, 2024.

Table 1. Distribution of children aged 0 to 14 years according to socio-demographic and clinical characteristics.

	Infection (%)	No infection (%)	p-value
Age			0.33
≤2 years	54 (21.0)	203 (79.0)	
>2 years	48 (19.8)	195 (80.2)	
Sex			0.83
Male	63(21.6)	228 (78.4)	
Female	39 (18.7)	170 (81.3)	
Origin			0.25
Ratoma	33 (17.0)	161 (83.0)	
Matoto	30 (21.4)	110 (78.6)	
Dixinn	12 (27.9)	31 (72.1)	
Matam	6 (20.0)	24 (80.0)	
Kaloum	5 (45.5)	6 (54.5)	
Dubreka	7 (20.0)	28 (80.0)	
Coyah	6 (20.0)	24 (80.0)	
Others*	3 (17.6)	14 (82.4)	
Reasons for consultation			
Fever	440 (97.8)	10 (2.2)	≤0.001
Convulsions	57 (24.2)	179 (75.8)	
Inability to drink	0 (0.0)	5 (100)	
Irritability	2 (6.1)	31 (93.9)	
Lethargy	29 (26.9)	79 (73.1)	
Disturbance of consciousness	2 (25.0)	6 (75.0)	
Neck stiffness	45 (34.6)	85 (65.4)	

Table 2. Distribution of children aged 0 to 14 years according to the appearance and results of CSF staining.

Appearance of CSF	Effective	Gram stain	
		Negative	Positive
		Workforce (%)	Workforce (%)
Clear	397	352 (88.7)	45 (11.3)
Hematic	63	41 (65.1)	22 (34.9)
Citrine yellow	9	2 (22.2)	7 (77.8)
Slightly cloudy	11	3 (27.3)	8 (72.7)
Purulent	1	0	1 (100)
Disorder	19	0	19 (100)

Table 3. Distribution of children aged 0 to 14 years according to the results of Gram staining and culture.

	Gram stain	Bacterial culture			Total
		Not tested by culture	Culture tested		
			Culture –	Culture +	
Gram –		336	62	0	398
Gram +		0	0	102	102
	Total	336	62	102	500

Table 4. Frequency of children aged 0 to 14 years according to antibiotic resistance.

Bacterial species	Antibiotics	Resistance	
		Effective	%
<i>Streptococcus pneumoniae</i> . N = 78	Vancomycin	71	91.0
	Cotrimoxazole	70	89.7
	Tetracycline	69	88.5
	Nalidixic acid	34	43.6
<i>Haemophilus influenzae</i> . N = 24	Cotrimoxazole	21	87.5
	Ticarcillin	18	75.0
	Cephalotin	15	62.5

4. Discussion

The samples collected during the survey from children aged 0 to 14 years at the pediatric department of Donka National Hospital was all tested fresh. This study has some limitations, namely the qualitative and quantitative insufficiency of certain samples as well as the unavailability of viral and fungal tests. The prevalence

of meningitis was 20.4%. Kwambana-Adams BA *et al.* [6] reported a prevalence of 23.8%. On the other hand, Oumou Konate reported a hospital prevalence of 4.11% [7]. More than three-quarters of the children surveyed were vaccinated against bacterial meningitis. Fever, convulsions, and neck stiffness were the most commonly reported reasons for consultation among children, with respective frequencies of 90%, 47.2%, and 26.0%. Our results are comparable to those of Hardie M. *et al.* [8], who in their studies reported that the reported indications for lumbar puncture in children were convulsions (38.5%), signs of meningeal irritation (21.4%), disturbances of consciousness (12.5%), and irritability (5.6%).

Regarding the appearance of the CSF collected from children, the majority was clear, followed by hematic and cloudy ones with respective proportions of 79.4%, 12.6% and 3.8%. We specify that the appearance was macroscopic carried out by the laboratory agents.

All cloudy cerebrospinal fluids were Gram-positive, followed by purulent ones. Almost all slightly cloudy and lemon-yellow fluids were Gram-positive. This could be explained by the fact that the macroscopic appearance of CSF most often reflects the degree of infection in patients.

Moreover, the samples collected from the children were all tested for Gram and a positivity of 20.4% was recorded. These positive samples were subsequently tested by culture for the purpose of identifying the bacterial species responsible for meningitis in these children. A 100% concordance of Gram and culture results were obtained. These frequencies are higher than those of Sow M *et al.* [5], who reported in their study a concordance of 35.48%. Subsequently, we recorded 76.5% of Gram-positive Diplococci and 23.5% Gram-negative Bacilli. Our results are comparable to those of Sow M *et al.* [5], who in their study carried out in Guinea on the microbiological profile of meningitis: analyses of cerebrospinal fluid at the national public health laboratory in 2017, reported that Gram-positive diplococci and Gram-negative bacilli were the most reported with respective frequencies of 27.59% and 13.79%.

Following culture, 76.5% of meningitis was caused by *Streptococcus pneumoniae* and 23.5% by *Haemophilus influenzae*. A study by Tsolenyanu *et al.* [9] on the etiology of pediatric bacterial meningitis in Lomé *Streptococcus pneumoniae* was also reported to be responsible for most infections, followed by *H. influenzae* with respective frequencies of 67.3% and 23.5%. Boni-Cisse C. *et al.* [3], in their study, also reported that the most widespread pathogen was *Streptococcus pneumoniae* with 71.4%.

Haemophilus influenzae was resistant to Cephalotin, cotrimoxazole and Ticarcillin. While *Streptococcus pneumoniae* was resistant to Vancomycin, Nalidixic acid, cotrimoxazole and Tetracycline.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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