Scientific Research Publishing

Advances in Infectious Diseases, 2026, 16(1), 135-147
https://www.scirp.org/journal/aid
ISSN Online: 2164-2656
ISSN Print: 2164-2648

Profile of Neuromeningeal Conditions in a Tropical Setting among Patients Admitted to the Department of Infectious and Tropical Diseases at CHNU De Fann Dakar: A Study of 930 Cases

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How to cite this paper: Mbaye, K.D., Fall, N.M., Massaly, A., Ly, A., Lakhe, N.A., Diouf, A., Badiane, A.S., Sambou, C.K., Thioub, D., Cissé, V.M.P., Ka, D., Ndour, C.T. and Seydi, M. (2026) Profile of Neuromeningeal Conditions in a Tropical Setting among Patients Admitted to the Department of Infectious and Tropical Diseases at CHNU De Fann Dakar: A Study of 930 Cases. *Advances in Infectious Diseases*, **16**, 135-147.
https://doi.org/10.4236/aid.2026.161010

Received: January 1, 2026
Accepted: February 7, 2026
Published: February 10, 2026

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Abstract

Introduction: Neuromeningeal disorders comprise a group of severe infectious and non-infectious pathologies, common and clinically diverse, that affect the central nervous system, primarily including meningitis, encephalitis, and suppurative infections. They are common and diverse, and for the most part, remain a public health concern worldwide and especially in Africa. **Objectives:** To assess the prevalence of neuromeningeal disorders among patients hospitalized in the Infectious and Tropical Diseases Department (SMIT) at CHNU de Fann, and to describe their epidemiological, clinical, paraclinical, and prognostic characteristics. **Patients and Methods:** This was a retrospective and descriptive cohort study conducted over five years, from January 1, 2018, to December 31, 2022. It included patients presenting with neuromeningeal disorders. **Results:** Of the 3567 hospitalized patients, 930 were admitted primarily for neurological symptoms, representing a prevalence of 26.07%. There was a clear male predominance (61.29%), with a sex ratio of 1.58. The mean age of the study population was 40 years [5 - 99 years]. Half (50.16%) of the patients came from suburban areas. The informal sector accounted for more than one third of reported cases (37.63%). Married individuals constituted the majority of our study population at 40%. The most frequently observed comorbidities were HIV (25.37%), hypertension (12.68%), diabetes (6.23%), and substance abuse (14%). The most frequent reason for hospitalization was febrile disturbances of consciousness (17.3%). Clinically, the most common signs were headache (61.93%), altered consciousness (69.35%), neck stiffness (40.53%), vomit-

ing (40.10%), motor deficit (29.89%), Kernig's sign (26.12%), and Brudzinski's sign (21.07%). The main etiologies were severe malaria in its neurological form (23.11%), neuromeningeal tuberculosis (17.84%), and bacterial meningoencephalitis (14.83%). The mean length of hospital stay was 11 days, ranging from a few hours to 100 days. Outcomes were favorable in 62.8% of cases and stationary in 5.80%. The overall case fatality rate was 31.4%. **Conclusion:** Neuromeningeal diseases are complex but can be effectively managed with prompt and appropriate intervention. However, it is essential to ensure the prevention of neuromeningeal opportunistic infections during HIV infection, as these typically carry a poor prognosis. Management of these conditions requires a multidisciplinary and collaborative approach.

Keywords

Neuromeningeal Disorders, Fann, Dakar, Infectious Diseases

1. Introduction

Neuromeningeal disorders may be caused by bacteria, viruses, fungi, or parasites and constitute a significant cause of morbidity and mortality in many regions worldwide, particularly in tropical areas. The tropical environment, characterized by specific climatic and environmental conditions, favors the proliferation of various pathogens. Precarious socioeconomic conditions, cultural beliefs, limited access to healthcare and information, and inadequate medical infrastructure further exacerbate the situation, increasing the vulnerability of local populations to neuromeningeal infections. In West African countries such as Mali, a prevalence of 21.14% [1] was reported in a 2011 study on neuromeningeal diseases.

In Senegal, studies conducted in 2005 [2] and in 2016 [3] reported overall prevalences of 11.4% and 16.26%, respectively, of neuromeningeal conditions at the infectious diseases clinic of the CHNU de FANN.

2. Patients and Methods

This was a retrospective and descriptive study. Data were collected from the medical records of patients hospitalized in the SMIT with neuromeningeal disorders, compiled over a five-year period from 1 January 2018 to 31 December 2022.

All patients were included, regardless of age or sex, who met at least one of the following clinical or paraclinical criteria: presence of a meningeal syndrome or clinical signs of encephalic involvement; cerebrospinal fluid abnormalities; presence of an infectious agent or its antigens in the cerebrospinal fluid on bacteriological or mycological examination; or presence of neuromeningeal abnormalities on brain imaging. Regarding severe malaria in its neurological form, the diagnosis was made thanks to a positive thick blood smear (presence of asexual forms of Plasmodium falciparum) associated with disorders of consciousness and/or prostration and/or convulsive seizures.

The analysis was conducted using R software version 4.4.0. Categorical variables were presented as absolute and relative frequencies. Quantitative variables were expressed as means ± standard deviation or as median (interquartile range), depending on whether the distribution was normal or not.

Operational definitions

The stages of coma were categorized as follows:

- Stage 1 coma or mild coma: slight impairment of consciousness with a Glasgow Coma Scale score between 12 and 14.
- Coma stage 2, or moderate coma: absence of coherent verbal response and motor response limited to painful stimuli, with a Glasgow Coma Scale score between 8 and 11.
- Stage 3 coma, or deep coma: complete absence of responses to external stimuli, with either abolition or marked reduction of reflexes (pupillary, corneal), and a Glasgow score of 3 - 7.
- Coma exceeded: Glasgow < 3: a state of brain death, characterized by the absence of cerebral activity. Vital functions are sustained solely through medical devices.

Regarding cellularity, it was considered normal if it was below 5 elements/mm^3.

The normal protein concentration in CSF is <4 mg/dl. When it exceeds 4 mg/dl, the condition is referred to as hyperproteinorachia.

Under normal conditions, cerebrospinal fluid glucose concentration ranges from 2.2 to 3.9 mmol/L.

The progression was considered favorable based on clinical improvement during treatment.

With regard to the ethical considerations, anonymity and confidentiality were maintained throughout the data collection process involving patients. Personal information was coded using numbers.

3. Results

From January 2018 to December 2022, a total of 3567 patients were hospitalized in the infectious and tropical diseases department. Among them, 930 patients were diagnosed with a neuromeningeal condition, corresponding to a hospital prevalence of 26.07% and an annual average of 185.8 cases. The mean number of cases was 15.5 per month. The condition occurred throughout the year, with peaks in the last quarter (October, November, December).

3.1. Sociodemographic Aspects

More than half of our study population was male (61.29%), corresponding to a sex ratio of 1.58. The mean age was 40 years [5 - 99 years]. The most represented age group was 21 - 40 years (43.12%, n = 401). Occupation was reported for 53.01% of patients. Various socio-professional categories were represented; the majority belonged to the informal sector (drivers, carpenters, masons, tailors, farmers, etc.), comprising 37.63% of hospitalized patients. Married individuals accounted for 40% of our study population. Medical and surgical histories were noted in 21.5% of patients, among whom pulmonary tuberculosis (18%) and ischemic or hemor-

rhagic stroke (14%) were most frequent. Among surgical histories, cerebral surgery was the most commonly reported, with 10 cases (1.07%). Smokers represented 14.63% of subjects, among whom there were consumers of Indian hemp, hookah, cocaine, and hashish. Alcohol use was reported in 7.63% of patients in our series. Comorbidities were present in 51.39% of cases (n = 478), including HIV infection (25.37%), hypertension (12.68%), and diabetes (6.23%) (**Table 1**).

Table 1. Distribution of neuromeningeal involvement according to sociodemographic characteristics, Infectious and Tropical Diseases Department, Fann University Hospital Center 2018-2022 (n = 930).

Aspects sociodemographic	Absolute frequency (n)	Relative frequency (%)
Sex		
Men	570	*61.30*
Women	360	*38.70*
Age		
≤20	122	*13.12*
[21 - 40]	401	*43.12*
[41 - 60]	279	*30*
≥60	128	*13.76*
Marital status		
Married	372	*40*
Single	323	34.73
Divorced	65	7
Widower	48	*5.16*
Not specified	122	13.11
Antecedents (n = 200)		
Pulmonary tuberculosis	36	*18*
AVCI/H	28	*14*
Meningitis	5	*2.5*
Malaria	6	*3*
Otitis	4	*2*
Recurrent angina	3	*1.5*
Others	118	*59*
Comorbidities		
HIV infection	236	*25.37*
Arterial hypertension	118	*12.68*
Diabetes	58	*6.23*
Other sites of tuberculosis	43	*4.62*
Psychiatric disorders	24	*2.58*
Asthma	24	*2.58*
Epilepsy	15	*1.61*
Others	43	*4.62*

3.2. Clinical Aspects

The main reasons for hospitalization reported were febrile coma, accounting for 162 cases (17.3%), meningeal syndrome (10.8%, n = 100), febrile headaches (9.5%), fever associated with general deterioration (5.8%), and focal syndrome in 4.8% of cases.

At admission, the meningeal syndrome triad was present in 2.68% of patients. Headache was the most common symptom, reported in 61.93% (n = 576) of cases. Vomiting (40.1%), constipation (4.7%), and visual disturbances such as blurred vision, diplopia, and photophobia (1.83%) were also observed.

Among general symptoms, fever was observed in 79.11% of patients in our study.

Among physical signs, consciousness disorders were observed in 69.14% of cases. Coma stage was specified for 67.29% of patients (n = 624): stage 1 coma (43.11%), stage 2 (46.80%), stage 3 (9.29%), and ultimately, transcendent coma stage (0.80%). Seizures (17%), motor deficits (30%), sensory deficits (7.7%), and dysarthria (5.6%) were also recorded.

Cranial nerve involvement was observed in 93 patients, specifically:

- Seventy patients with seventh nerve involvement (loss of hemifacial motility or facial diplegia);
- Twelve cases involving the third cranial nerve (ptosis, strabismus);
- Involvement of the sixth cranial nerve (horizontal diplopia);
- Lesions of the ninth cranial nerve (dysphagia, curtain sign);
- Six lesions of the III and VII cranial nerves;
- Two lesions of the third and sixth cranial nerves;
- Involvement of cranial nerves VII and IX.

All of these clinical features are detailed in Table 2.

3.3. Paraclinical Aspects

In the absence of contraindications, lumbar puncture was performed in 490 patients, corresponding to over half of the cases (52.68%). The lumbar puncture was clear in 3% of cases. The macroscopic appearance of the CSF was reported for 428 patients, representing 87.34%. CSF was predominantly clear in 74.76% of cases. Cellularity was reported in 86.93% of cases, ranging from fewer than one cell to innumerable leukocyte clusters. Patients with cellularity < 5 cells accounted for nearly half of the study population (47.42%). Additionally, 7.04% of patients had a cellularity greater than 1000. In our series, lymphocytes were most frequently observed in the CSF (48.5%), followed by altered polymorphonuclear cells at 18.77%. Hyperproteinorachia was present in 60.47% of cases, while glycorrhachia had similar proportions. Of 309 lumbar punctures analyzed for bacteriology, 7.11% were positive. The most frequently identified organism was *Streptococcus pneumoniae.* The India ink examination was performed in 23.67% of cases and was positive in only 1.72%. Of two cryptococcal antigen test results, one was positive. Eight viral PCR tests were conducted, yielding six positive results, including

three identified viruses. Of 140 CSF Xpert/MTB/RIF tests performed, 14.28% were positive (Table 3).

Table 2. Distribution of neuromeningeal involvements according to clinical presentations, Department of Infectious and Tropical Diseases, CHNU de Fann 2018-2022 (n = 930).

Characteristics	Absolute frequency (n)	Relative frequency (%)
	Reasons for Consultation	
Febrile coma	162	*17.4*
Meningeal syndrome	132	*14.2*
Febrile headaches	88	*9.5*
Fever and general deterioration of condition	54	*5.8*
Focal syndrome	45	*4.8*
Seizures with or without fever	40	*4.3*
Febrile agitation	41	*4.4*
Other	368	*39.6*
	CLINICAL SIGNS DURING HOSPITALIZATION	
Headaches	576	61.9
Vomiting	373	*40.1*
Constipation	44	*4.7*
Visual impairment	17	*1.8*
Disorder of consciousness	643	*69.1*
Seizure crises	158	17
Motor deficit	279	30
Sensory deficit	72	7.7
Dysarthria	52	5.6
Cranial nerve involvement	93	10

Table 3. Distribution of neuromeningeal involvement according to paraclinical CSF aspects, Department of Infectious and Tropical Diseases, CHNU de Fann 2018-2022 (n = 930).

Characteristics	Absolute frequency (n)	Relative frequency (%)
	BACTERIOLOGY	
Streptococcus pneumoniae	12	*4*
Staphylococcus spp	03	*1*
Staphylococcus aureus MRSA	03	*1*
Haemophilus influenzae	01	*0.3*
Enterobacter spp	01	*0.3*
Acinetobacter spp	01	*0.3*
Gram-positive cocci	01	*0.3*
Total	22	*7*

Continued

CHINESE INK EXAMINATION (n = 116)		
Positive	2	*1.7*
Negative	114	*98.3*
TEST XPERT/MTB/RIF (n = 140)		
Positive	20	*14.3*
Negative	120	*85.7*
VIRAL PCR (n = 8)		
Positive	**6**	***75***
- Epstein Barr virus	3	*37.5*
- VZV	2	*25*
- HHV7	1	*12.5*
Negative	**2**	***25***

Additional paraclinical examinations were performed. Fifty out of 56 patients tested positive for malaria using the rapid diagnostic test (RDT), corresponding to a rate of 89.29%. Thick blood smear, carried out in 20.43% of our study population, was positive in 84.74% of cases. Syphilis and toxoplasmosis serologies were each performed in 0.96% of cases, with 55.56% of tests yielding positive results for each infection. The Xpert/MTB/RIF test on gastric aspirate fluid, performed in 15.69% of cases, was positive in 30.14% of subjects.

In imaging, cerebral computed tomography (CT) was performed in more than half of the patients, 59.03% (n = 549). It was normal in 234 patients, representing 42.62% of cases, and contributed to the diagnosis in 57.01% of cases. The abnormalities detected on CT were predominantly of infectious origin (26.24%) and vascular origin (22.22%). Other causes, mainly including hydrocephalus and trauma, accounted for 4.73%. MRI was performed in 56 patients, representing 6.02% of cases. Among the results obtained (n = 53), MRI was normal in 11 cases. Abnormal findings, observed in 4.51% of our study population, included tuberculoma/target-like lesions (15 cases), ischemic or venous thrombosis events (06 cases), and suppurative processes (empyema/abscess) in 04 cases. Additionally, isolated cases of cerebral lymphoma, intracranial expansive processes (metastasis), leukopathy, and leukoencephalopathy were noted. Cerebral MRI was found to be more specific than cerebral CT, allowing us to detect suggestive findings even in patients with normal CT scans.

3.4. Etiological Aspects

Bacterial and parasitic causes were the most frequent in our series, accounting for 37.63% and 27.75%, respectively. The etiology remained undetermined in 5.7% of our study population (n = 53). Bacterial causes accounted for 37.63% of cases, with neuromeningeal tuberculosis being the most common etiology, observed in

17.85% of cases. Intracranial suppurations (3.65%) were distributed as follows: 2.15% (20 cases) of cerebral abscess and 1.50% (14 cases) of cerebral empyema.

Parasitic etiology was the second most frequent cause, with a prevalence of 27.75%. However, severe malaria in its neurological form (cerebral malaria) was the most recurrent condition in our study population, accounting for 215 cases, or 23.12%. Cryptococcal neuromeningitis was the only fungal cause identified, with 3 cases (0.33%). Viral causes were observed in 7.21% of cases, mainly viral encephalitis at 2.58%. Opportunistic infections with neuromeningeal involvement were recorded at a rate of 2.69%.

A total of 61 cases of unclassified meningitis, meningoencephalitis, and encephalitis were also diagnosed, representing 6.55% of our cohort. Among non-infectious causes, vascular etiologies were the most common at 7.42%, and were often associated with infectious conditions. In relation to our study population, tumors were the rarest causes, accounting for 0.75% of cases. We also identified a few rare cases of neurological disorders (1.82%), such as Neuro-Behçet syndrome and hydrocephalus, as well as psychiatric conditions including postpartum psychosis, acute delusional episodes, and depression.

Metabolic causes included hepatic encephalopathies, hypoglycemic coma, Gayet-Wernicke encephalopathy, and toxic encephalopathy (**Figure 1**).

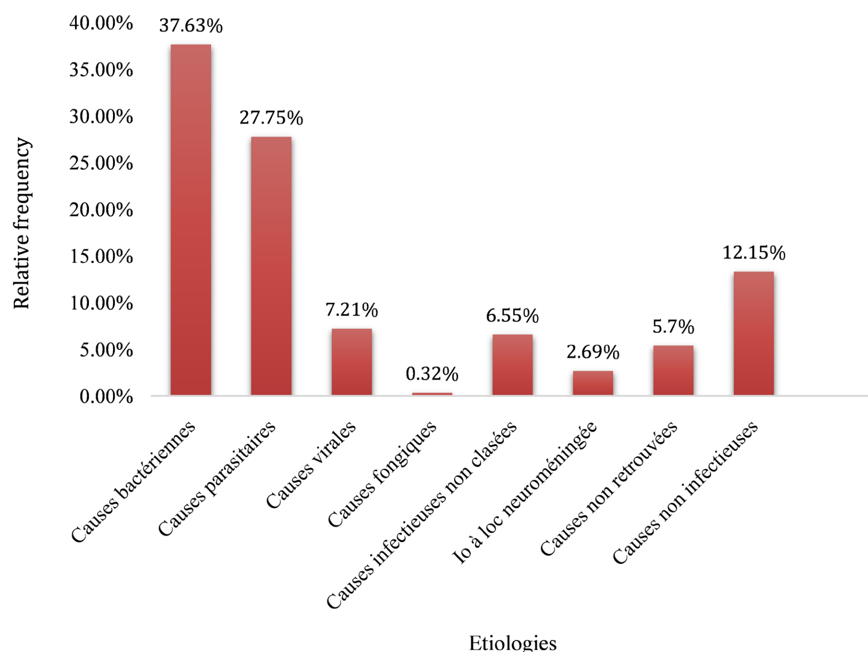

Figure 1. Distribution of patients admitted for neuromeningeal disorders by etiology, SMIT Fann 2018-2022 (n = 930).

3.5. Evolutionary Aspects

In our study, 348 cases (37.41%) experienced at least one complication during hospitalization. The most frequently observed complications were severe anemia (8.6%), respiratory distress (7.63%), and herniation (7.31%).

The average length of hospitalization was 11 days, ranging from a few hours (in cases where the patient died on the same day of admission) to 100 days.

The outcome was favorable in 62.80% of cases (n = 584), while 292 patients died, corresponding to an overall fatality rate of 31.40%; 5.80% (n = 54) remained in a stable condition.

Discharge to home was achieved in 60.97% of cases, while 5.70% of patients were transferred to specialized departments (intensive care, neurosurgery, neurology, psychiatry, etc.).

Among the etiologies with the highest number of deaths were infectious meningitis with a case fatality rate of 65%, neuromeningeal opportunistic infections (60%), metabolic causes (57.14%), and unidentified etiologies (52%).

4. Discussion

Our retrospective and descriptive study covered a five-year period from January 1, 2018, to December 31, 2022, and included all patients hospitalized in the infectious diseases department of CHNU de FANN for a neuromeningeal condition.

We collected 930 cases of neuromeningeal disorders among a total of 3567 hospitalized patients, corresponding to an overall prevalence of 26.07%. The peak in admissions occurred in the last quarter of the year.

This high frequency observed in our study is likely attributable to Senegal being a malaria-endemic area, with cases of severe malaria, particularly in its neurological form. Additionally, Senegal lies within the Lapeysonnie meningitis belt, leading to cases of meningitis, and the incidence of neurologically localized opportunistic infections associated with HIV/AIDS infection is tending to increase. The rise in case numbers during the last quarter of each year is explained by the fact that this period in Senegal corresponds to the end of the rainy season, which is marked by the epidemic peak of severe malaria, particularly in its neurological form, as demonstrated by the work of Lakhe *et al.* [4].

The average age was 40 years, ranging from 5 to 99 years. These results are comparable to those reported by Mjigal H. [3] in Senegal. Similarly, comparable findings were observed in other studies, such as those by Mailles A. (39.7 years) in France [5] and by Zayet *et al.* (43 years) in Tunisia [6]. This mean age is slightly higher than the 37 years found by Samake [7] in 2015 in Bamako among patients with infectious diseases. There was a clear male predominance, with a sex ratio of 1.58. This result corroborates those obtained by other African authors, namely Soumare M. *et al.* [2] in Senegal, with a sex ratio of 1.83, and Coulibaly D.S. *et al.* [8] in Mali, with a sex ratio of 1.9, Zayet *et al.* in Tunisia [6]. In contrast, in the study by Yassibanda *et al.* [9], there was gender parity. This male predominance may be explained by the fact that, in general, the male population has more risk factors for developing central nervous system pathologies. Married individuals (40%) constituted the largest group. Deguenovo-Fortes L. *et al.* [10] found in their study on the profile of HIV-infected patients a predominance of married patients, with a prevalence of 56% superior to ours. The informal sector was well repre-

sented (37.63%), in contrast to the study by Y Assibanda *et al.* [9] which reported a higher proportion of unemployed patients (56.5%). The socioprofessional context plays a significant role; individuals at risk are those with a low socioeconomic status, for whom exposure risk is associated with factors environmental factors, including overcrowding, humidity, and poor ventilation in housing.

Comorbidities were observed in 51% of cases, consistent with Zayet *et al.* [6], who reported 45% comorbidities. The main comorbidities identified were HIV infection (25.37%), hypertension (12.68%), and diabetes (6.23%). This predominance of HIV infection has also been reported in studies conducted in Senegal and Mali by Deguenovo-Fortes L [10] and Coulibaly *et al.* [8]. This finding may be explained by the fact that all these studies were conducted in infectious disease departments, which serve as reference centers for the management of people living with HIV (PLHIV). According to the Malian study by Anicet [11] among PLHIV, hypertension was the most frequently found comorbidity (69.2%), followed by diabetes (23.1%).

Clinically, the most frequently observed neurological sign was Headaches (61.93%) were reported. These results are similar to those obtained in Senegal by Soumaré *et al.* and Diallo-Mbaye *et al.* [2] [12] [13], who observed them in 86%, 62%, and 81.8% of cases, respectively. Meningeal signs such as neck stiffness, Kernig's sign, and Brudzinski's sign were observed in 40.53%, 26.12%, and 21.07% of cases, respectively. Coma was noted in 69.14% of cases and fever in 78.58%. The literature reports similar findings: in Côte d'Ivoire, in the study by Eholié *et al.* [14] coma was present in 92% and fever in 85% of cases; in Tunisia, Zayet *et al.* [6] found altered consciousness in 71% of patients and fever in 70%. However, the study by Mjigal H. [3] reported a prevalence of 15.4% for coma and 51.57% for fever. Behavioral disturbances were observed in 26.12%, seizures in 16.98%, and cranial nerve involvement in 10% of our study population. These results are similar to those of Hane W. [15], who reported seizures in 16.18% and behavioral disturbances in 26.12%. Focal signs such as sensory and motor deficits were present in 7.74% and 29.89% of our patients, respectively. These figures are higher than those reported by Mjigal H. [3] in Senegal, in the same department ten years earlier.

Lumbar puncture was performed in 52.68% of our patients. Macroscopically, cerebrospinal fluid (CSF) was clear in 74.77% of cases. Our results are consistent with those from Coulibaly D.S. *et al.* [8], who found clear CSF predominating in 67.3% of cases, and Soumaré M. *et al.* [2], who reported 58.5% of cases. Cytological analysis revealed lymphocytes in 48.5% of cases, altered polymorphonuclear cells in 18.77%, and non-altered polymorphonuclear cells in 18.5%. Biochemically, hyperproteinoarachia was seen in 60.47% of patients, while glycorrhachia was equally distributed. This aligns with findings by Zayet *et al.* [6], who found hyperproteinoarachia in 84% of their study population. Despite the suspicion of bacterial etiologies, the diagnosis was microbiologically confirmed in only 7.1% of cases (n = 22). This low positivity rate may be due to the limited availability of

advanced technical resources, but also to the fact that our patients often lack the means to undergo all the required tests (multiple PCR), which are expensive. In other cases, this may indicate bacterial meningitis suppressed by antibiotic therapy or early-stage meningitis. Indeed, negative bacteriological results from CSF are often due to initial antibiotic use before sampling. In the study by Seydi M. *et al.* [16] of 152 meningococcal meningitis cases, 40% of patients had received ampicillin or amoxicillin before admission, antibiotics with 100% in vitro efficacy against the pathogen. Regarding viruses identified through viral PCR, we detected three viruses: EBV (2 cases), HHV7 (1 case), and VZV (2 cases). Additionally, a respiratory virus, SARS-CoV-2, was identified from a nasopharyngeal swab by positive viral PCR. Mycobacterium *tuberculosis* detection by Xpert/Mtb/Rif in the CSF, performed in 140 patients, was positive and rifampicin-sensitive in 20 patients, representing a prevalence of 14.28%. These results align with those of Hane W. [15], who found 12.12%, and Zayet *et al.* [6], who reported 11 positive cases among 57 patients, but are lower than Thiam A. [17], who observed a prevalence of 25%. In our series, 89.29% of malaria rapid diagnostic tests (RDT) were positive. Thick smear was positive in 84.74%. As the malaria RDT is highly sensitive, false negatives may occur when parasitemia is low, as reported by Degbohoue A. [18]. The malaria infection rate, based on the positivity of both thick smear and RDT in our patients, is probably underestimated, given the presumptive antimalarial treatment generally received by patients prior to hospitalization.

Neuromeningeal conditions are characterized by their radiological polymorphism. In our study, cerebral CT was performed in 59.03% (n = 549) of cases and revealed abnormalities in 57.01% of them. Among these, infectious pathologies were identified in 26.23%, vascular in 22.22%, tumoral in 1.82%, and degenerative in 2%. Brain MRI was performed in 6.02% of patients, with lesions detected in 4.51% of cases. All patients in Zayet *et al.* [6] underwent a CT scan, and 61% had an MRI. Soumaré *et al.* [2] found CT abnormalities in 60% of cases. MRI and CT remain the preferred examinations in the presence of focal neurological signs, but their cost limits their use in our countries. Other supplementary investigations, such as chest radiography, Xpert/Mtb/Rif on gastric aspiration fluid or sputum, and sputum examination for AFB, have in some cases provided multiple arguments in favor of neuromeningeal tuberculosis, even though radiological lesions are not specific.

Regarding clinical progression, the median length of hospital stay was 11 days, ranging from several hours to 100 days. These results are consistent with those of Zayet *et al.* [6], who reported a median hospital stay of 15 days. The outcome was favorable in 62.80% of cases; 54 patients, representing 5.80%, were transferred to various specialized departments for more appropriate management. Complications observed included severe anemia (8.6%), respiratory distress (7.63%), and herniation (7.31%). The Tunisian study [6] reported two cases of herniation and 21 cases of septic shock.

Overall mortality was 31.40% (292 deaths). This rate is lower than that reported

by Soumare M [2] in the same department several years earlier, but also lower than that found by Zayet *et al.* [6] who reported a mortality rate of 47%. Nevertheless, it is considerably higher than the 15.38% reported by Diarra B. [1] at CHU du Point G in Mali. Despite this, mortality remains high in our study, which may be explained by delayed diagnosis due to patients' limited resources as well as delays in management resulting from lengthy therapeutic pathways and late consultation at healthcare facilities.

5. Conclusion

Neuromeningeal disorders are diverse and require prompt, appropriate, and multidisciplinary management through collaborative approaches. However, it is essential to upgrade the technical capacities of our diagnostic support services, particularly by equipping them with immunological and molecular biology diagnostic tools. Given that most patients attending our healthcare facilities come from socially disadvantaged backgrounds, measures should be taken to make the costs of paraclinical examinations, especially imaging, more financially accessible.

Conflicts of Interest

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

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