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Febrile Seizures in Children Aged 1 Month to 15 Years: Etiologies and Management at the Pediatric Department of the N'Zérékoré Regional Hospital

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Abstract

Objective: The aim was to study the epidemiological aspects of febrile seizures and to identify etiologies in children from 1 month to 15 years old who were received in the pediatric department of the N'Zérékoré Regional Hospital. **Patients and Methods:** This was a six-month, prospective, descriptive, cross-sectional study conducted from June 6 to December 6, 2018, involving 125 patients seen in consultation and/or hospitalized for febrile seizures. **Results:** During this study, we recorded 125 cases of febrile seizures (96.15%). The male-to-female ratio was 1.31, with a male predominance. The age group 0 – 5 years was the most affected (89.60%). Fever was present in 108 of our patients (87.10%), and all experienced one or more episodes of seizures (100%). Among the seizure types, tonic-clonic seizures were present in 88.8% of cases and lasted more than 15 minutes. Severe malaria and bacterial meningitis were the most frequent etiologies (90.4% and 35.48%, respectively). Diazepam was the most commonly used anticonvulsant (98.36%). **Conclusion:** Febrile seizures are a frequent reason for consultation and hospitalization in the pediatric department of the N'Zérékoré Regional Hospital. The types of seizures and their duration have prognostic value, primarily within the context of the underlying cause. Treatment should be tailored to the diagnosed cause.

Keywords

Seizures, Children, N'Zérékoré Hospital

1. Introduction

Febrile seizures are defined as the sudden onset of a motor discharge originating in the brain, which may be persistent or transient, occurring in a febrile context with loss of consciousness. This definition encompasses not only seizures caused by a simple rise in temperature (hyperpyretic seizure) but also seizures resulting from direct damage to the brain [1]. Seizures represent the most frequent medical emergency in pediatrics and are the subject of often passionate debate regarding their etiology, risk factors, and therapeutic management [1]. Their frequency varies between 3% and 38% [2] [3]. The nature of these febrile seizures, however, remains a subject of controversy [2]-[4].

They are either the consequence of cerebral dysfunction induced by fever (cases of febrile seizures) or the symptomatology of a true epileptogenic encephalopathy, infectious or non-infectious. They are the subject of debate regarding etiology, risk factors, and therapeutic management [1]. The prognosis depends on the cause, the type of febrile seizure, the neurological background, and the promptness of treatment. Management combines symptomatic treatment with well-conducted etiological treatment.

In Guinea, little data is available on febrile seizures in children; therefore, we undertook this study, the main objective of which was to investigate the etiologies of febrile seizures in children aged 1 month to 15 years in the pediatric department of the Nzérékoré Regional Hospital.

2. Patients & Methods

This was a prospective, descriptive, cross-sectional study conducted over a six-month period, from June 6 to December 6, 2018, in the pediatric department of the N'Zérékoré Regional Hospital, located 1000 km from Conakry in southern Guinea. This department has a threefold mission: training, research, and patient care.

We included all children aged 1 month to 15 years admitted for febrile seizures confirmed by questioning and/or physical examination, with the consent of their parents or legal guardian. Children over 15 years of age and those with non-febrile seizures were excluded.

2.1. Simple Seizure

- Generalized, bilateral, and symmetrical seizures;
- Age under 12 months;
- Duration under 15 minutes;
- Good psychomotor development;
- Does not recur within 24 hours.

2.2. Complex Seizure

Any one of the following criteria is sufficient to define a complex seizure:

- Partial or hemibody seizures;
- Duration > 15 minutes;
- Age under 12 months;
- Recurrence of the seizure within 24 hours;
- Presence of postictal deficit;
- Presence of focal signs, even transient ones, following the seizure.

Data were collected using a standardized questionnaire.

We focused on the following parameters:

Sociodemographic data (age, sex, place of origin), clinical data (history of febrile seizures, psychomotor development, vaccination status, temperature, nature of seizures, associated clinical signs), biological characteristics (thick blood film, CSF cytology), the diagnosis, treatment, and outcome. For immediate emergency management, we applied standard measures, namely: clearing the upper airway, providing oxygen therapy, and monitoring hemodynamic parameters. If a seizure lasted longer than 5 minutes, diazepam was administered rectally at a dose of 0.5 mg/kg. An infectious workup and lumbar puncture were performed to determine the etiology of the febrile seizures. CSF culture, Gram staining, antigen testing, and PCR were not performed due to the unavailability of reagents. The N'Zérékoré Regional Hospital is a secondary-level hospital in the Guinean healthcare system and is located more than 1000 km from the capital, Conakry. Treatment will depend on the etiology.

Data were collected manually on a survey form. Data entry and text processing were performed using Microsoft Office 2019 and Epi Info 7.2.0. Patient anonymity was maintained throughout the study period and even after the results were presented. Parental consent was obtained for patient enrollment in the study.

3. Results

3.1. Sociodemographic and Clinical Data

During the study period, we collected 125 cases of febrile seizures out of a total of 1800 patients admitted to the pediatric ward, representing a frequency of 6.94%.

Almost all patients experienced complex seizures (94.4%), and 88.8% had tonic-clonic seizures.

Table 1. Distribution of patients according to sociodemographic and clinical characteristics.

		Effective (N = 125)	Percentage (%)
Sex	Male	71	56.8
	Female	54	43.2
Age (years)	1 months - 5	102	89.6
	6 - 10	10	8
	11- 15	3	2.4

Continued

Clinical characteristics	38.5˚ - 39˚	115	92
	>39˚	10	8
Nature of the seizures	Complex	118	94.4
	Simple	7	5.6
Type	Tonic-clonic	111	88.8
	Clonic	7	5.6
	Tonic	7	5.6

The 1-month to 5-year age group was the most represented, accounting for 89.60% of cases. The mean age was 2.99 ± 1.46 years, with a range from 2 months to 15 years. The male-to-female ratio was 1.31 (Table 1).

All our patients experienced one or two episodes of febrile seizures (100%).

Upon admission, the majority of patients (68%) had a temperature between 38.5˚C and 39˚C, while 8% had a temperature above 39.5˚C.

3.2. Paraclinical Data

Table 2. Distribution of patients according to paraclinical characteristics.

Tests	Results			
	Normal		Pathological	
	Effective	%	Effective	%
Thick blood films (N = 125)	12	9.6	113	90.4
Blood cultures	0	0	0	0
Hemoglobin levels (N = 125)	116	92.8	9	7.2
CSF (N = 117)	73	62.39	44	37.60

All patients underwent a thick blood smear, which was positive in 90.4% of cases. Hemoglobin levels were systematically checked in all patients, with 7.2% showing abnormal results. We performed a lumbar puncture in 93.6% of cases, and the causative organism was identified in 37.6% of these (Table 2).

Table 3. Frequency of patients according to the etiology of febrile seizures.

	Frequency (N = 125)	Percentage
Neuromalaria	113	90.4
Bacterial meningitis	44	35.2
Pulmonary infections	28	22.4
Febrile gastroenteritis with seizures	6	4.8

The most common causes of febrile seizures in this study were cerebral malaria and bacterial meningitis, accounting for 90.4% and 35.2% of cases, respectively.

Cerebral malaria was associated with bacterial meningitis and pulmonary infections, with transient symptomatic dispersion that could be life-threatening. A limitation of the study was the lack of a brain CT scan. For the diagnosis of bacterial meningitis, patients underwent lumbar puncture with direct examination of the cerebrospinal fluid (CSF). A white blood cell count (leukocytes/mm^3) above 5 was considered abnormal (Table 3).

Table 4. Distribution of patients according to etiological treatment.

	Effective	Percentage
Anticonvulsant	125	100
Antimalarial	113	90.4
Antipyretic	86	68.8
Antibiotic	72	57.6
Antidiarrheal	6	4.8

Anticonvulsants were used in all our patients, followed by antimalarials and antipyretics, in 90.4% and 68.8% of cases, respectively (Table 4).

The dosage of diazepam was 0.3 mg/kg as a single rectal dose, repeated after 5-10 minutes if seizures persisted. Phenobarbital was then administered as a single oral dose of 5 - 10 mg/kg if seizures continued. The antimalarial used was an artemisinin derivative (artesunate) at a dosage of 3 mg/kg for patients under 20 kg and 2.4 mg/kg for those over 20 kg, administered at 0, 12, and 24 hours via slow intravenous injection. This was repeated every 24 hours depending on the patient's clinical condition. Ceftriaxone was the most frequently used antibiotic at a dose of 100 mg/kg/day administered by slow intravenous injection.

The outcome was favorable without neurological sequelae in 93.6% of patients, and all were followed up after hospital discharge. However, we recorded 3 deaths, representing 2.4% of cases.

Table 5. Distribution of patients according to the outcome of hospitalized children.

	Frequency	Percentage
Recovered without lasting effects	117	**93.6**
Recovered with lasting effects*	5	4
Deaths	3	2.4
Total	125	100

*Deafness, speech disorders, mental and intellectual disorders.

All our patients underwent a neurological evaluation before their discharge from the hospital and the most common type of sequelae was meningeal encephalitis (4 cases) and auditory deafness (1 case) (Table 5).

4. Discussion

We conducted a 6-month prospective, descriptive, cross-sectional study during which we recorded 125 patients admitted for febrile seizures out of a total of 1800 hospitalizations, representing a hospital frequency of 6.94%. Our results are similar to those of Dembélé A *et al.* in Mali [5], who reported a prevalence of 8.4%. However, our results are significantly lower than those of M. J. Alao *et al.* [6] in Benin and Diawara *et al.* [7] in Mali, who found prevalences of 16.88% and 16.58%, respectively.

The majority of our patients (68%) came from urban centers. Our results are lower than those of Sidibé MD *et al.* [8], who found that 82.86% of patients came from urban areas. This result could be explained by the fact that the N'Zérékoré Regional Hospital is located in the heart of the city, with a high population density, thus facilitating access in the event of a health emergency.

We observed a predominance of seizures in children aged between 1 month and 5 years (89.60%), with a mean age of 2.99 ± 1.46 years and a range of 2 months to 15 years. The male-to-female ratio was 1.31. Several studies in the sub-region had noted an age lower than 36 months [2] [3]. Our results are comparable to those of Diawara N. *et al.* [2] in Bamako, who found a predominance of febrile seizures in children aged 12 to 24 months. This could be explained by the immaturity of the central nervous and immune systems, which makes these children particularly vulnerable. Data from the literature indicate that febrile seizures account for 2 to 5% of cases [9]. The authors suggest that the high incidence in young children is due to the immaturity of the autonomic nervous system [10]. It is clear that age-related cerebral immaturity plays a major role in triggering febrile seizures in response to the various stresses occurring during an infectious disease.

All our patients experienced one or two episodes of febrile seizures, representing 100% of cases. Data from the literature indicate that febrile seizures account for 2% to 5% of cases [9]. Ear, nose, and throat (ENT) disorders are common in our countries due to climatic variations and, above all, increasing overcrowding in our cities.

On admission, the majority of patients had a temperature that fluctuated between 38.5˚C and 39˚C, *i.e.* 92% of cases, and those who had a temperature above 39.5˚C were 8%.

Our results are significantly higher than those of Dembélé *et al.* in Mali, who found that 42.1% of cases in children had a temperature between 38.5˚C and 39.4˚C, and those of Sall *et al.* in Senegal [11], who recorded similar results with 43.3% of temperatures between 38.5˚C and 39.4˚C and 36.3% above 39.5˚C. However, Kaputu *et al.* [12] noted a temperature above 39˚C in 57.8% of cases.

Almost all patients experienced complex generalized seizures, 94.4% of which were tonic-clonic, lasting more than 5 minutes. Our results are considerably higher than those found by Dembélé *et al.* in Mali [5], who found that generalized seizures were the most frequent, at 65.8% of cases, and primarily tonic-clonic seizures in 64.7%. In contrast, M J Alao *et al.* [6] in Benin found a predominance of

localized seizures in 50.30% of cases.

All patients underwent a thick blood smear, and it was positive in 90.4% of cases. Our results are comparable to those of Dembélé *et al.* [5], who reported that 72.2% had a positive thick blood smear. Guinea is part of the area of high malaria endemicity in sub-Saharan Africa, with the presence of the Plasmodium falciparum species and high mortality, especially among children under five.

The most common etiologies of febrile seizures in this study were cerebral malaria and bacterial meningitis, accounting for 90.4% and 35.2% of cases, respectively. Our results are superior to those found by Nkombo MN *et al.* in Congo, who found that cerebral malaria was identified as the cause of febrile seizures in 62% of cases at the University Clinics of Lubumbashi, compared to 52.5% of cases at the Sendwe General Referral Hospital [13]. Djoman Aspi. *et al.* in Abidjan [14] found that the etiologies of febrile seizures were dominated by severe malaria in its convulsive (47.6%) and neurological (25%) forms, followed by bacterial meningitis (13.1%).

Neurological signs are characteristic of Plasmodium falciparum malaria [15]. Seizures are frequent, even in cases of uncomplicated infection. The seizures are generally generalized and may precede the onset of a coma. These crises are most often reversible but associated with significant neurodevelopmental sequelae: stroke, cognitive disorders and increased risk of epilepsy [16].

These results could be explained by the fact that we are in a malaria-endemic zone and Guinea is part of the African meningitis belt; therefore, malaria and meningitis are the main causes of febrile seizures in children. Despite malaria prevention measures such as the use of long-lasting insecticidal nets, malaria remains the leading cause of hospitalization in children in Africa, a finding consistent with those reported by Hogan B [17] in Ghana, Kiemde in Burkina Faso [18], and José Francisco Fernandes in Gabon [19].

The most frequently prescribed anticonvulsant was diazepam 100%. Our result is similar to that found by Bisimwa Mushagalusa *et al.* in the Democratic Republic of Congo, who recorded 100% diazepam use [8]. Paracetamol was the most frequently used antipyretic and/or analgesic in 68.8% of cases.

Our results are similar to those of Dembele A *et al.* in Mali [5], who found that 67.7% of cases involved the use of antipyretics in combination with anticonvulsants, compared to 55% for Bisimwa Mushagalusa *et al.* [18].

The most frequently used molecules for etiological treatment were antimalarials and antibiotics, at 90.4% and 57.6%, respectively. Our results are significantly higher than those of Dembele A *et al.* in Mali [5], who reported that antimalarials (67.3%) and antibiotics (22.9%) were the most frequently used etiological treatments.

In our study, the outcome was favorable without neurological sequelae in 93.6% of cases. We recorded 3 deaths, representing 2.4%. This rate was significantly lower than that of Dembélé A *et al.* in Mali [5] who found 41.6% deaths and that of Diawara *et al.* [7] who found 20.3% deaths.

5. Conclusion

Febrile seizures are a frequent reason for consultations and hospitalizations in children aged 1 month to 15 years at the Pediatric Department of the N'Zérékoré Regional Hospital. The main causes of febrile seizures were cerebral malaria and bacterial meningitis. The outcome was favorable without sequelae in the majority of our patients. Improved prevention and management of common infectious diseases will help reduce the still very high mortality rate of febrile seizures.

Conflicts of Interest

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

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