

Epidemiological Aspect of Febrile Convulsive Seizures in Infants and Children in Libreville, Gabon

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Abstract

A prospective, observational and transverse study, carried out in pediatric emergency units and in-patients at Centre Hospitalier de Libreville and Hôpital Régional de l'Estuaire de Mélen, from May to September 2011, included 99 infants and children aged between 6 months and 15 years admitted for convulsive seizures in a febrile context. These seizures represented 3.0% of paediatric hospitalisations in Libreville.

The mean age was 42.5 ± 31.2 months, with extremes of 6 and 132 months. Sex ratio was 1.2. Most children were under 5 years old. Their parents were mostly High school educated, and without income-generating activities. Birth took place in healthcare centres (97.0%) through vaginal route (97.0%). Histories of convulsions with fever were reported in 25.2% of patients. Simple seizure was the most frequent (64.2%) with a predominance of generalized tonic-clonic seizures. A state of convulsive failure was noted in 10.5% of patients. Malaria was the main cause in 50.5% of patients, including 5 cases of severe malaria, followed by febrile convulsions in 36.4% and purulent meningitis in 17.1% cases. Hypocalcaemia was found in 26.1% of patients. The average hospital stay was 5 ± 2 days. The disease evolution was favourable for 91.9% of children and death was recorded for 4.1%.

Febrile convulsive seizures are a leading cause of hospital admissions in Libreville and the prognosis depends on etiology. In order to improve management of such patients and to avoid sequelae, further bacteriological and virological investigations are needed, as well as ruling out severe malaria or meningitis, reinforcing anti-malaria prevention methods and raising families' awareness about meningitis vaccine.

Keywords: Seizure; Convulsion; Febrile; Child; Prognostic

Introduction

Febrile seizure is a frequent reason for consultation and hospitalization in paediatric wards around the world and in Africa. It corresponds to an abrupt cerebral motor discharge, occurring in a febrile context accompanied by altered consciousness and include febrile convulsions and symptomatic acute febrile seizures. Febrile seizure is a public health issue, a diagnostic and therapeutic emergency due to subsequent convulsive states, and neurological or neurocognitive sequelae [1-3]. Etiologies are multiple: bacterial, parasitic or viral infections and metabolic disorders in a febrile context. In Europe, they occur during ear-nose- throat or lower respiratory tract infections

[4,5]. In sub-Saharan Africa, Mali, hospital prevalence has been estimated at 16.5% and in Cameroon, malaria has been found as the leading cause [6,7]. In Gabon, little data has been published on febrile seizure.

Aim of the Study

This work aimed at improving the prognosis of febrile convulsive seizure, with the objective of assessing its frequency, describing the characteristics of febrile convulsions and febrile acute symptomatic seizures, identifying the etiologies and understanding the evolving profile.

Patients and Method

This was a prospective, observational and cross-sectional study, which took place from May to September 2011 in the pediatric emergency and in-patients units of Libreville Hospital Center (CHL) and Melen Regional Hospital (HREM). The study population consisted of children aged 6 months to 180 months (15 years) with febrile seizures. Children with fever associated convulsions, i.e. rectal temperature greater than or equal to 38° Celsius, were included. Children with a non-febrile seizure, or with any chronic neurological disease, and children whose parents refused to participate in the study were not included. The data were collected on a standardized form. Variables included socio-demographic features (age, sex, place of residence, parents education and occupation), personal history (childbirth, medical history, previous episodes of fainting or fever associated convulsions), general examination results (temperature, state of consciousness, Blantyre coma score), physical examination and paraclinical checkup results (blood count, "thick smear" test and/or Rapid Diagnostic Test, blood sugar and blood calcium levels and lumbar puncture with cytological, chemical, virological and bacteriological analysis of cerebrospinal fluid).

Operational definitions

Febrile seizure has been defined as the occurrence of a seizure in a febrile context, from the age of one month, without central nervous system infection, with no history of non-febrile seizures or epilepsy since the neonatal period [4,5]. Simple seizure is short (< 15 minutes), with no recurrence in 24 hours, and neurological status is recovered within 60 minutes. Complex seizure lasts longer than 15 minutes, recurring within 24 hours and followed by a post-ictal neurological deficit. The symptomatic acute febrile seizure has been defined as a condition of convulsive state in a febrile setting secondary to a central nervous system infection. Seizure disorder was defined as a seizure lasting longer than 30 minutes or a series of seizures with no recovery of consciousness between them. Deep coma was defined as a Blantyre Score less than or equal to 2 and any other altered consciousness state had a score between 2 and 5 and. Hypoglycemia was defined as a blood glucose level below 2.5 mmol/fasting and hypocalcaemia as a blood glucose level below 2.1 mmol/l.

Data were collected with Excel and statistically analysed through Statview and Epi info 6 softwares. Chi-Square Tests were performed to compare categorical variables. Mann Whitney and Kruskal Wallis tests were used to compute continuous data.

Results

Out of 4074 examined or hospitalized children, 119 presented with convulsions associated with fever, i.e. a hospital frequency of 3.0%. A total of 99 children met the inclusion criteria. The mean age was 42.5 ± 31.2 months, with extremes of 6 and 132 months. Children under 60 months (i.e. 5 years) of age accounted for 76 cases (76.8%). Age group below 12 months represented 16 cases (16.2%) and age group between 12 and 24 months represented 22 cases (22.2%) (Table 1).

	Number of cases (n)	Percentage (%)
Age (months)		
< 12	16	16,2
[12 - 24]	22	22,2
[25 - 36]	14	14,1
[37 - 48]	17	17,2
[49 - 60]	7	7,1
> 60	23	23,2
Total	99	100,0

Table 1: Population characteristics by age.

Sex-ratio was 1.2 with 53 (53.5%) male children and 46 (46.5%) female children. Libreville was the place of residence for 86.0% children. A total of 69.1% parents were high school educated, 35.4% had no income-generating activity, 32.3% were students, and 28.3% parents were workers. Delivery took place in health centres for 96 patients (97.0%). Vaginal delivery was predominant (97.0%), and forceps were used for 1.1% cases. A percentage of 1.0% preeclampsia and 1.0% delivery hemorrhage were observed. Prematurity was the condition of 6.4% children and 3.2% needed neonatal resuscitation. A quarter of children (25.2%) presented with history of fever associated convulsions and 1.0% had homozygous sickle cell disease (Table 2).

	Number of cases (n)	Percentage (%)
Sex		
Male	53	53,5
Female	46	45,5
Parents Professional status		
Employee	28	28,3
Pupil/Student	32	32,3
Artisan	4	4,0
No activity	35	35,4
Delivery condition		
Vaginal	96	97,0
Caesarean	3	3,0
Forceps	1	1,0
Pre-eclampsia	1	1,0
Deliverance hemorrhage	1	1,0
Place of delivery		
Health Center	96	97,0
Home	3	3,0
Birth condition		
Neonatal resuscitation	3	3,0
Prematurity	6	6,0
Medical history		
Convulsions with fever	25	25,2
Homozygous Sickle Cell Disease	1	1,0

Table 2: Population characteristics by sex, parents occupation, personal and medical history, birth place, status and condition.

Generalised seizure was predominantly recorded (91.9%), with sixty-nine (75.8%) tonic-clonic cases, and 6.0% partial seizure. Simple seizure accounted for 64.2% of children and complex seizure for 10.5%. A state of convulsive disorder was observed for 10.5% of patients, post-ictal neurological deficit for 1%, with tetraparesis, language and hearing disorders. Post-ictal coma occurred for 3.0% and prolonged coma for 17.2%. Other neurological signs (10.1%) were observed such as obtundation, psychomotor agitation, screaming and abnormal movements. Pleuro-pulmonary signs were present in 5 cases with acute respiratory distress syndrome in 3 cases and digestive syndrome was found in 3 cases. Clinical signs were undefined in 19 cases (19.2%) and no syndrome was found in 15.1% of patients. Etiologies were malaria in 50 cases (50.5%); purulent meningitis in 17 cases (17.1%) and encephalitis in 2 cases (2.0%). Febrile convulsions were noted in 36 cases (36.4%). A low respiratory infection was observed in 21 cases, including bronchopneumopathy in 8 cases, infection of the otorhinolaryngological sphere in 14 cases and febrile gastroenteritis in 5 cases. Hypoglycemia was diagnosed in 1.7% of cases and hypocalcemia in 26.1% of cases. The average length of stay was 5 ± 2 days. Evolution was favourable in 91.9% of cases. Cases of death were recorded (4.1%) and 2% recurrences occurred after a period of one month (Table 3).

	Number of cases (n)	Percentage (%)
Type of crisis Generalized (n = 91)		
Tonico-clonics	69	75,8
Tones	17	17,5
Atonics	5	5,2
Partial (n = 6)		
Tones	6	6,0
Not Defined (n = 2)	2	2,0
Etiologies		
Malaria	50	50,5
Febrile convulsions	36	36,4
Undetermined etiology	19	19,2
Lower respiratory tract infections	21	21,0
Purulent meningitis	17	17,1
Otorhinolaryngologic infections	14	14,0
Gastroenteritis	5	5,0
Encephalitis	2	2,0
Evolution profile		
Full recovery	91	91,9
Death	4	4,1
Recurrence	2	2,0
Stationary state	1	1,0
Discharge against medical advice	1	1,0

Table 3: Population distribution by type of crisis, etiologies and evolving profile.

Out of fifty children with malaria, 57.0% were less than five years of age and 30.4% over five years old. The age group under 12 months accounted for 26.5% and the age group between 12 and 24 months accounted for 34.7%. Seizure was generalized and 39 tonic-clonic cases (81.1%) were diagnosed. Seizure was simple in 32 cases or complex (36.0%). Seizure disorder occurred in 6 cases (12.0%) and neuropaludisme with coma in 5 cases (10.0%). Co-infection was found in 12 cases with meningitis in 6 cases; otorhinolaryngological infection in 5 cases and 1 case of bronchopneumopathy. Two (4.0%) deaths were reported among children with cerebral malaria.

From seventeen children with meningitis, 15.8% were less than 5 years old, 9 of whom were less than 36 months. Meningeal syndrome was unequivocal. Seizure was generalized with tonic-clonic in 8 cases (47.1%) or tonic in 7 cases (41.2%). Simple seizure was observed in 70.3% of cases and complex in 9 cases (53.0%). Seizure disorder was reported for 3 cases (17.6%) and coma for 6 cases (35.3%). *Streptococcus pneumoniae* was the causative agent in 2 cases.

Out of the thirty-six children with febrile seizure, 16.7% were less than 12 months old, 38.8% (14 cases) were 12 to 24 months old and 19.4% (7 cases) were 25 to 36 months old. Seizure was generalized and tonicoclonic in 20 cases (55.6%) or complex in 7 cases (19.4%); a state of convulsive disorder with coma was reported in 1 case (2.8%). Otorhinolaryngological infectious syndrome was found in 9 cases, a pleuropulmonary syndrome in 5 cases and a digestive syndrome in 3 cases.

Discussion

Febrile seizure has low prevalence. Studies from Nguéfack, *et al.* in Cameroon, Berkley, *et al.* in Kenya, and Senga, *et al.* in Congo report high rates of respectively 6.1%, 8.3% and 9.6% [7-9]. Higher values were found in Mali by Diawara, *et al.* (16.58%) and by Dembélé, *et al.* (14.34%) [6,10]. These differences are explained by the variability in definitions for the inclusion criteria. They can also result from seizure itself, which can be underestimated when it occurs at home and overestimated if it is confused with trembling. Younger children (less than 5 years old) are the most affected. Similar observation was made by Diawara, *et al.* in Mali, with a rate of 82.2% children under 5 [6]. Immature brains may present with an age-related neuronal hyperexcitability induced by fever [11,12]. The 12 to 24 months age group division has similar ratio to Diawara, *et al.* (27.8%) [6]. For Dembélé, *et al.* in Mali, the 12 to 59 months age group was the most represented (75.6%) [10]. Male children were the most exposed, as reported by Graveleau, *et al.* in France and Senga P, *et al.* in Congo-Brazzaville, with male predominance (59.25%) [9,13]. Nguéfack, *et al.* found a sex ratio of 1.5 and Dembélé, *et al.* found a sex ratio of 1.31 [7,10]. Male susceptibility is explained by a neurobiological difference between the neurons of male and female children, resulting in a differentiation of responses at the onset of brain injury [14]. The ratio of children with a history of febrile seizures was similar to several studies suggesting that approximately 30.0% of children with febrile seizures recur in a subsequent febrile condition [11]. Nguéfack, *et al.* in Cameroon reported that 31.4% of children had already had a seizure [7]. Perinatal pathological history, including neonatal resuscitation and prematurity associated with a birth weight less than 2500 grams may be incriminated. Sall, *et al.* in Senegal, considered perinatal pathological antecedents in 2.8% cases to be etiological factors [15]. Higher values of low birth weight children were reported by Nguéfack, *et al.* in Cameroon with 16.9% [7]. Studies have reported that the risk of febrile seizures increases significantly with decreasing birth weight [16]. Generalized and tonicoclonic seizures were the most common. Diawara, *et al.* in Mali found a ratio of 97.2% for generalized seizure and 60.2% in case of tonicoclonic type [6]. The frequency of simple seizure was similar to Nguéfack, *et al.* in Cameroon with 58.7% [7]. Lower values were reported by Dembélé, *et al.* in Mali with 34.2% [10]. The ratio of complex seizure was lower than Dembélé, *et al.* in Mali who reported 65.8% [10]. Etiologies of febrile seizure are the same reported in most studies in Africa. Diawara, *et al.* in Mali reports hyperpyretic convulsions (34.25%), neuromalaria (33.3%) and meningitis (15.7%) as the main causes. Dembélé, *et al.* in Mali observed neuromalaria (69.9%), bacterial meningitis (14.7%) and hyperpyretic convulsions (9.0%) [6,10]. The frequency of hyperthermia-related attacks is similar to Diawara, *et al.* studies, in Mali with 34.2% [6]. Lower rates of hyperpyretic convulsions have been reported by Nguéfack, *et al.* in Cameroon with 6.1% and by Sall, *et al.* in Senegal with 3.45% of hospitalizations [7,15]. This difference can be explained by the variable prevalence throughout the year of the infectious pathologies responsible for febrile attacks. The main causes identified were similar to those reported by several authors. Nguéfack, *et al.* in Cameroon, found malaria (67.7%), ear-nose-throat infections (14.1%) and lower respiratory infections (9.8%) to be the cause of fever [7]. Diawara, *et al.* in Mali reports pneumopathies (35.1%), ear, nose and throat disorders (27.1%), convulsive malaria (16.2%) and diarrhoea (10.8%) [6]. The high prevalence of hyperpyretic seizures associated with malaria was reported by Chiabi, *et al.* in Cameroon with 39.0% and by Kariuki, *et al.* in Kenya with 38.0% of cases [17,18]. These studies find a decrease in frequencies of attacks when the prevalence of malaria drops. In Europe, infections of the otorhinolaryngologic or pulmonary spheres predominate [13,19,20]. The ratio of purulent meningitis was similar to that reported by Diawara, *et al.* in Mali

and Joshi., *et al.* in Nepal with 17.0% and 15.7% respectively [6,21]. They are the third most common etiology of hyperthermal seizures in children and are most common before the age of three, when the risk of morbidity and mortality is highest [22,23]. This ratio is confirmed by Diawara., *et al.* in Mali and Senga., *et al.* in Congo-Brazzaville who found purulent meningitis in children under one year of age [6,9]. *Streptococcus pneumoniae* has been reported by Diawara., *et al.* in Mali, by Anga., *et al.* in New Guinea and by Joshi., *et al.* in Nepal as the causative agent [6,21,24]. The low ratio can be explained by the systematic absence of cerebrospinal fluid analysis in all suspect patients. The difficulty of cytologic analysis did not allow confirmation of the diagnosis of viral infection in children with clear cerebrospinal fluid. Malaria meningitis co-infection was found by Kariuki., *et al.* in Kenya between 4.0% and 14.0% and by Bronzan., *et al.* in Malawi [18,25]. This coinfection ratio stresses the problem of etiology in hyperpyretic seizure. Parents' low socio-economical status makes it difficult to carry out biological or radiological examinations needed for etiological research. The proportion of children with a state of convulsive disorder is comparable with Diawara., *et al.* in Mali, who report a ratio of 7.4% only in conditions affecting brain structures [6]. Hospital mortality related to febrile seizures is very low and similar to that reported by Diawara., *et al.* in Mali with 3.6% [6]. This lethality was related to etiology.

Conclusion

Febrile seizure is a frequent symptom among children in Libreville. Younger children, less than 5 years old are particularly affected, with male predominance. Seizure may be generalized, tonic-clonic or simple. Malaria is the primary cause. Otorhinolaryngological infections are the most frequent etiologies for febrile convulsions related to fever. Purulent meningitis was observed as the most frequent condition for symptomatic acute febrile attacks.

Improving febrile seizure morbidity and mortality prognostics needs early diagnosis and early management. Access to further complementary tests for etiological diagnosis, strengthening of malaria prevention methods and raising awareness of meningitis vaccination are the key factors in the strategy.

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