



## Usefulness of Lumbar Puncture During the First Febrile Seizure in Children; A Series of 182 Patients

**K. Abidi**

Department of pediatrics,  
Children's University Hospital, Marrakech, Morocco

**W. Lahmini**

Department of pediatrics,  
Children's University Hospital, Marrakech, Morocco

**M. Bourrouss**

Department of pediatrics,  
Children's University Hospital, Marrakech, Morocco

### ABSTRACT

**Purpose:** Our study's objectives are to describe the epidemiological, clinical, paraclinical, etiological evolutionary aspects of febrile seizures (FS) in children, as well as to evaluate the contribution of lumbar puncture (LP) in FS in children. **Methods:** Our research includes a cross-sectional review of all children admitted for a febrile seizure and whose age is between 6 months and 5 years. A retrospective study carried out in the pediatric emergency department at university hospital center Mohammed VI over the period from 2020 to 2022; in this period 182 patients were admitted. **Results:** FS accounted for 4.37% of emergency hospitalizations, with a peak in frequency during the winter. The average age was 18 months. The majority of hospitalized children were from a low socioeconomic level (71.5%). The temperature on admission was between 38.5 and 39.4°C in 44.5% of cases. Simple FS were the most frequent (69.8%). The LP made in all patients was always normal. Gastroenteritis and respiratory infections were the most frequent etiologies of fever. Etiological treatment was also instituted for patients according to the etiology. The evolution was marked by the improvement of the patients. No deaths have been reported. **Conclusion:** The likelihood of bacterial meningitis or encephalitis in uncomplicated FS without any other signs is extremely low, regardless of the age of the child. In front of a simple FS without any evocative sign of meningitis or encephalitis, the LP is not necessary, even before 18 months

**Keywords:** Lumbar puncture, Febrile seizures, Children, Antiseizure drugs, Meningitis

### INTRODUCTION

Throughout the first five years of life, febrile seizures occur between 2 and 5% of the times. Although febrile seizures are mostly benign, there is a 14.8% documented recurrence rate during the same fever episode and about a 30% recurrence within two years [1]. Due to the possibility of convulsive status and neurological sequelae, it is a diagnostic and therapeutic

emergency [2]. In this article, we study the clinical, paraclinical and etiological profile of febrile seizures as well as the usefulness of lumbar puncture during the first convulsion.

## METHODS

Our research includes a cross-sectional review of all children admitted for a febrile seizure and whose age is between 6 months and 5 years. A retrospective study carried out in the pediatric emergency department at university hospital center Mohammed VI over the period from January 2020 to January 2022; in this period 182 patients were admitted. The objectives are to describe the epidemiological, clinical, paraclinical, etiological and evolutionary aspects of febrile seizures (FS) in children, as well as to evaluate the contribution of lumbar puncture (LP) in FS in children.

## RESULTS

FS accounted for 4.37% of emergency hospitalizations, with a peak in frequency during the winter. The average age was 18 months with extremes varying between 6 months and 5 years, and a median age of 14 months. The study of the distribution of FS by age had shown that the age group between 13 and 18 months was the most affected with 41.21%. A 1.25 sex ratio indicated a modest male predominance. The majority of hospitalized children were from a low socioeconomic level (71.5%). All children have been properly vaccinated according to the National Immunization Program. The pathological antecedents were distributed as follows: Six cases of neonatal suffering, five cases each of neonatal infection and neonatal respiratory distress, and two cases of preterm were reported. In 11 patients, or 6.04%, epilepsy in the family history was recognized.

All the children in our series had a fever, and the temperature on admission was between 38.5 and 39.4°C in 44.5% of cases. Simple FS were the most frequent (69.8%), 93.96% of instances were tonic-clonic seizures, which made up the majority of seizures, of the cases examined, the neurological examination was abnormal in 52 individuals (28.6%), with tone problems were found in 45 cases (24.7%) and neck stiffness in 7 patients (3.8%). Bloody diarrhea, which was present in 70 children, or 38.46% of all cases, in our case series, was the clinical symptom most frequently linked to seizures. We also noted 18 patients who presented rales or crackles on pulmonary auscultation, and 8 cases who presented sibilant rales. The LP made in all patients was always normal. For the infectious assessment, a Blood count/CRP was performed in all the patients, which revealed hyperleukocytosis in 85.2% of the patients. Of these, 30.2% had CRP levels greater than 100 mg/L, increased in 55.5% of the cases (between 30 and 100 mg/L), and 11.5% had levels between 6 and 30 mg/L. The brain scan was performed in 53.8% of all the cases studied. It was recommended for any patient with complex CF or in case of simple CF with a neurological anomaly. In all of our patients, it had not revealed any abnormalities.

Gastroenteritis and respiratory infections were the most frequent etiologies of fever representing 38.5% and 24.2% respectively. While urinary infections and ENT infections represented respectively 21.98% and 3.3% of all cases studied, three patients had a post-vaccination FS, and 26 patients had fever, although the cause had not been identified.

All of our patients had regular hospitalization, with an average stay of three days (extremes of 2 to 7 days). The standard was to administer an anticonvulsant plus an antipyretic. At the beginning, all of our patients received antibiotic therapy; the prescription chosen was a

meningeal dose of third-generation cephalosporins; in 18.1% of cases, Gentamycin was added; and in 15.9% of all instances, Metronidazole was administered. All of the 55 kids (30.2%) who had complicated FS when they were first diagnosed received preventive care. All of our patients experienced a positive short-term evolution, which was characterized by the onset of apyrexia and an improvement in the accompanying functional symptoms. Throughout our series, no deaths were reported. Given that the long-term evolution was difficult to follow.

## DISCUSSION

The prevalence of febrile seizures is highest in the Asian population, where they affect 3.4–9.3% of Japanese children and 5–10% of Indian children, compared to just 2-5% of kids in the United States and Western Europe [3.4]. This ethnic disparity can be explained by either a specific genetic susceptibility to FS or by the different inclusion criteria used by each author. In the period of our investigation, fever seizures accounted for 4.37% of hospital admissions. A Japanese study found that febrile seizures were more common in the winter and summer. This result was explained by the fact that respiratory virus infections were more common in the winter and gastrointestinal virus infections in the summer [5]. South Korea [3] and Italy [6] both reported outcomes that were comparable. The wintertime had already been linked to an increase in the prevalence of FS in other studies [7.8].

Increased neuronal excitability occurs during development, predisposing the kid to febrile seizures [9]. As a result, we can claim that FS is an immature brain response to fever and that it is highly linked with age [9.10]. Thus, FS applied mainly in children before the age of 3 years while they are rare before 6 months and after 3 years [9.11], with a peak frequency between 12 and 18 months [3.4]. The maximum frequency in our study is between 13 and 18 months, which is in accordance with the data in the literature. Studies, such as those by Han and al. [12] and Shrestha and al. [13], have shown a little male predominance, which is consistent with our findings. Higher socioeconomic regions of Brazil have a lower incidence of FS, according to Dalbem and al [14]. As according numerous other research, those of low socioeconomic level make up the largest percentage of the population [15]. 9.9% of the patients in our analysis had a neonatal history. According to Chakir's study [16], the rate was 7.5%, while Koné's study revealed that 2.8% of patients had a neonatal history [17]. Children in our study who had a temperature between 38.5° and 39.4° were the most common, accounting for 44% of instances. Similar findings were found in the study by Dembélé and al., with 42.1% of temperatures ranging between 38.5° and 39.4° [18]. Among the clinical and sociodemographic variables, only the degree of fever proved to be an important risk factor for recurrence of FS [19]. Our research revealed that 69.8% of all instances had a simple convulsion, which was the most common type. These findings agree with those of Chakir, who discovered that 78.91% of cases had simple FS [16]. Our series' convulsive crises were primarily tonic-clonic (93.96%), which is in line with the data from the literature [18.20].

The American Academy of Pediatrics (AAP) reminds that paraclinical examinations should be focused on finding an infectious cause of fever rather than acting as a routine assessment for the convulsion as such in its most recent recommendations [21]. In 1996, and according to the AAP, the LP was recommended in any FS. Currently, according to the latest recommendations of the AAP, lumbar puncture is not systematically requested, the Japanese Society of Child Neurology has updated its recommendations in the same direction, and it no longer considers LP as a routine examination for children who have had FS [21.22]. According to the Okubo

and al. study, from 2010 to 2016, noted a marked decrease in the use of LP in the case of FS [23].

After the introduction of the Haemophilus Influenzae Type b and pneumococcal vaccines in 1987 and 2000, respectively, the incidence of acute bacterial meningitis (ABM) in children decreased significantly [24.25]. It is crucial to rule out meningitis because seizures are a common meningitis symptom in young children. Although lumbar punctures are not always clinically necessary for children with FS, they should be performed if there are any meningitis-related symptoms or if there is a history of meningitis or an intracranial infection [21.4.22.26.27]. Regardless of age, the American Academy of Pediatrics recommends lumbar puncture for children who were receiving antibiotics (decapitated meningitis) before to the episode [21]. If there has been no Haemophilus influenzae or S. pneumoniae immunization or if the vaccination status is unknown in infants with CF aged 6 to 12 months, lumbar puncture is recommended [21.27]. Evidence from several studies suggests that in a child presenting with a complex febrile seizure without signs suggesting meningitis or encephalitis on physical examination, the likelihood of bacterial meningitis is extremely low. Thus, some studies have found that routine LP does not seem to be required based only on the complex characteristics of the seizure and that a brief hospital stays for close observation may also be a reasonable decision in these children [21.28.29.30]. Contrary to the literature's data, in our study, the PL was carried out on nearly all of our patients (94,5%). This overprescription may be explained by the attitude that doctors have toward emergencies in order to avoid ignoring meningitis and by their inability to distinguish between cases that call for PL. It therefore seems reasonable to modify our first-contact management protocol in accordance with the new AAP recommendations.

In our study, the complete blood count was overly specified, and in several studies, hyperleucocytosis was revealed in more than half of the observations [16.31]. Consider that it is generally accepted that a hyperleucocytosis, which results from the demarginalization of leucocytes during a convulsive episode, can only point toward a bacterial infection if it is extremely high and associated with a significant polynucleosis. However, as Rutter and Smales point out, a hyperleucocytosis during CF cannot be used as an argument for the prescription of an antibiotherapy. This last one needs to be based mainly on the demonstration of an infectious focus on clinical examination [32.33]. CRP cannot distinguish between bacterial and viral infections; thus, it is necessary to compare its rate to that of the clinic, which must always take priority, especially when deciding whether to perform a lumbar puncture. CRP was assessed in our study and in contrast to findings in the literature, it was positive in 97% of patients. Elhassouni's study found that CRP was positive in just 26.1% of patients [31]. There are no data in the literature suggesting that children who presented with typical febrile seizures have more intracranial abnormalities or are at risk for neuronal damage. Therefore, there is no indication to perform a brain scan or MRI in these children [34.35]. For children experiencing their first simple febrile seizure, the AAP does not advise routine neuroimaging [21.36]. If meningitis is ruled out, the next step is to determine the tests needed to determine the disease causing this fever. It is theoretically possible for FS to coexist with any febrile disease in young children [37]. The most frequent cause in Oriental countries is infection of the upper and lower respiratory tracts. They are generally of viral origin [38]. In our study, infectious gastroenteritis was the cause of fever in 38.5% of cases. Similarly, in a study from Iran, infectious gastroenteritis was the most dominant cause of fever with a frequency of 69.5% [39]. Upper respiratory tract

infection and acute gastroenteritis were also the main causes of fever in a study in Nepal, with a prevalence of 45% and 42% respectively [40]. Similar results were reported in the study by Eskandarifar et al. [41] and in the study by Khazaei et al [42]. It should be mentioned that FS, which occurs post-vaccination, is quite rare and often occurs within the first three days after administration of live attenuated vaccines. The concurrent administration of multiple vaccines is believed to increase the risk of developing FS [43]

## CONCLUSION

The management of convulsions in a context of fever remains problematic. Indeed, regular biological exams no longer seem appropriate in this situation, and the indications and value of lumbar puncture (LP) are debatable. Clinicians evaluating the infant or toddler should determine the etiology of the fever after a straightforward febrile seizure. Each febrile infant should have meningitis evaluated in the differential diagnosis, and a lumbar puncture should be done if there are any clinical indications that point to meningitis.

## Conflict of Interest

The authors have no conflicts of interest to declare.

## References

1. Risa Hashimoto, Maiko Suto, Mariko Tsuji, Hatoko Sasaki, & al Use of antipyretics for preventing febrile seizure recurrence in children: a systematic review and meta-analysis 2021;180(4):987-997
2. Francis Jr, Richmond P, Robins C, Lindsay K, Levy A, Effler Pv, et al. An observational study of febrile seizures: the importance of viral infection and immunization. *BMC pediatrics*. 2016;16(1):1-6.
3. Chung S. Febrile seizures *Korean journal of pediatrics*. 2014;57(9):384
4. Leung Ak, Hon Kl, Leung Tn. Febrile seizures: an overview. *Drugs in context*. 2018;7.
5. Nishiyama I, Ohtsuka Y, Tsuda T, Inoue H, Kunitomi T, Shiraga H, et al. An epidemiological study of children with status epilepticus in Okayama, Japan. *Epilepsia*. 2007;48(6):1133-7.
6. Manfredini R, Vergine G, Boari B, Faggioli R, Borgna-Pignatti C. Circadian and seasonal variation of first febrile seizures. *The Journal of pediatrics*. 2004;145(6):838-9
7. Mikkonen K, Uhari M, Pokka T, Rantala H. Diurnal and Seasonal Occurrence of Febrile Seizures. *Pediatric Neurology*. 2015 Apr 1;52(4):424-7.
8. Okubo Y, Handa A. National trend survey of hospitalized patients with febrile seizure in the United States. *Seizure*. 2017; 50:160-5.
9. Sharawat Ik, Singh J, Dawman L, Singh A. Evaluation of risk factors associated with first episode febrile seizure. *Journal of clinical and diagnostic research: JCDR*. 2016;10(5):SC10.
10. Kaputu Kmc, Mafuta Me, Dubru Jm, Leroy P, Tomat Am, Misson Jp. Epidémiologie et caractéristiques des convulsions fébriles de l'enfant. *Revue Médicale de Liège*. 2013;68(4):180-5.
11. Aa, Bachur Rg, Torres A, Harper Mb. Febrile seizures: emergency medicine perspective. *Current opinion in pediatrics*. 2015;27(3):292-7.

12. Kim Sy, Lee Nm, Yi Dy, Yun Sw, Lim Is, Chae Sa. Seasonal distribution of febrile seizure and the relationship with respiratory and enteric viruses in Korean children based on nationwide registry data. *Seizure*. 2019; 73:9–13.
13. Shrestha N, Shrestha D, Shrestha A, Shrestha M. A retrospective study of clinical presentation of child with febrile seizure and its duration. *Am J Pediatr*. 2020;6(3):341–5.
14. Dalbem Js, Siqueira Hh, Espinosa Mm, Alvarenga Rp. Febrile seizures: a population-based study. *Jornal de pediatria*. 2015; 91:529–34.
15. Choi Yj, Jung Jy, Kim Jh, Kwon H, Park Jw, Kwak Yh, et al. Febrile seizures: Are they truly benign? Longitudinal analysis of risk factors and future risk of afebrile epileptic seizure based on the national sample cohort in South Korea, 2002–2013. *Seizure*. 2019;64:77–83.
16. A. Chakir. Etude rétrospective des convulsions fébriles au service de pédiatrie A CHU Marrakech. *Thèse médicale de Marrakech, n°127, année 2012*.
17. Mr Adama Mamadou Koné. Les convulsions fébriles dans le service de pédiatrie de l'hôpital Gabriel touré. *Thèse de Mali, année 2006*.
18. Dembélé A, Maiga B, Touré A, Traoré B, Cissé Me. Étiologies des Convulsions Fébriles Chez l'Enfant de 1 à 59 Mois dans le Service des Urgences Pédiatriques du CHU Gabriel Touré. *Health Sci. Dis* 20(3) May, 2019.
19. Gontko-Romanowska K, Żaba Z, Panieński P, Steinborn B, Szemień M, Lukasik-Głębocka M, et al. The assessment of risk factors for febrile seizures in children. *Neurologia i Neurochirurgia Polska*. 2017;51(6):454–8.
20. Gafforova Vf, Tadjieva Dt. Features of the course of febrile seizures in children. *Asian journal of pharmaceutical and biological research*. 2021;10(1).
21. Pediatrics Aa Of. Neurodiagnostic Evaluation of the child with a simple febrile seizure. *Pediatrics*. 2011;127(2):389–94.
22. Natsume J, Hamano S Ichiro, Iyoda K, Kanemura H, Kubota M, Mimaki M, Et Al. New guidelines for management of febrile seizures in Japan. *Brain and Development*. 2017;39(1):2–9.
23. Okubo Y, Hayakawa I, Nariai H, Michihata N, Matsui H, Fushimi K, Et Al. Recent practice patterns in diagnostic procedures anticonvulsants, and antibiotics for children hospitalized with febrile seizure. *Seizure*. 2019;67:52–6.
24. Adams Wg, Deaver Ka, Cochi Sl, Plikaytis Bd, Zell Er, Broome Cv, et al. Decline of childhood Haemophilus influenzae type b (Hib) disease in the Hib vaccine era. *Jama*. 1993;269(2):221–6.
25. Whitney Cg, Farley Mm, Hadler J, Harrison Lh, Bennett Nm, Lynfield R, et al. Decline in invasive pneumococcal disease after the introduction of protein–polysaccharide conjugate vaccine. *New England Journal of Medicine*. 2003;348(18):1737–46.
26. Yang JH, Villegas R, Khanna S, Kaswick J, Coufal NG, Crawford J, et al. The Utility of Infectious and Neurodiagnostic Testing in Children with Complex Febrile Seizures Requiring Mechanical Ventilation. *J Child Neurol*. 2021;36(9):735–42.

27. Auvin S, Antonios M, Benoist G, Dommergues Ma, Corrad F, Gajdos V, et al. Évaluation d'un enfant après une crise fébrile: focus sur trois problèmes de pratique clinique. *Archives de Pédiatrie*. 2017;24(11):1137-46.
28. Guedj R, Chappuy H, Titomanlio L, De Pontual L, Biscardi S, Nissack-Obiketeki G, et al. Do all children who present with a complex febrile seizure need a lumbar puncture? *Annals of Emergency Medicine*. 2017;70(1):52-62.
29. Shinnar S, Glauser Ta. Febrile seizures. *Journal of child neurology*. 2002;17(1\_suppl):S44-52.
30. Fletcher Em, Sharieff G. Necessity of lumbar puncture in patients presenting with new onset complex febrile seizures. *Western Journal of Emergency Medicine*. 2013;14(3):206.
31. Elhassouni Fatima. Intérêt de la ponction lombaire chez les nourrissons et les enfants moins de 5 ans. A propos 167 cas. *Thèse de Rabat, n° 182, année 2013*.
32. Rutter N, Smales Or. Role of routine investigations in children presenting with their first febrile convulsion. *Archives of Disease in childhood*. 1977;52(3):188-91.
33. Biyani G, Ray Sk, Chatterjee K, Sen S, Mandal Pk, Mukherjee M. Leukocyte count and C reactive protein as diagnostic factors in febrile convulsion. *Asian Journal of Medical Sciences*. 2017;8(2):56-8.
34. Smith Dk, Sadler K, Benedum M. Febrile seizures: risks, evaluation, and prognosis. *American family physician*. 2019;99(7):445-50.
35. Srinivasan J, Wallace Ka, Scheffer Ie. Febrile seizures. *Australian family physician*. 2005;34(12).
36. Provisional Committee on Quality Improvement on Fs. Practice parameter: the neurodiagnostic evaluation of the child with a first simple febrile seizure. *Pediatrics*. 1996;97(5):769-72.
37. Oluwabusi T, Sood Sk. Update on the management of simple febrile seizures: emphasis on minimal intervention. *Current opinion in pediatrics*. 2012;24(2):259-65.
38. Pokorn M, Jevšnik M, Petrovec M, Steyer A, Mrvič T, Grosek Š, et al. Respiratory and enteric virus detection in children: a prospective study comparing children with febrile seizures and healthy controls. *Journal of Child Neurology*. 2017;32(1):84-93.
39. Mahyar A, Ayazi P, Azimi E, Dalirani R, Barikani A, Esmaeily S. The relation between urinary tract infection and febrile seizure. *Iranian journal of child neurology*. 2018;12(4):120.
40. Shrestha D, Dhakal Ak, Shakya H, Shakya A, Shah Sc, Mehata S. Clinical characteristics of children with febrile seizure. *J Nepal Health Res Counc*. 2014 Sep 1;12(28):162-6.
41. Eskandarifar A, Fatolahpor A, Asadi G, Ghaderi E. The risk factors in children with simple and complex febrile seizures: an epidemiological study. *International Journal of Pediatrics*. 2017;5(6):5137-44.
42. Khazaei T, Hossein Ze, Javadzadeh M. Frequency of convulsion in infants hospitalized in Zahedan pediatric hospital. *Journal of Birjand University of medical sciences*. 2008. Volume 14,4(33), pages45-52.
43. Principi N, Esposito S. Vaccines and febrile seizures. *Expert review of vaccines*. 2013;12(8):885-92.