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Original Research Article

A Study on the Clinical Profile and Recurrence of Febrile Seizures in Pediatric Patients

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Abstract:

Background: Febrile seizures (FS) are the most common seizure disorder in children aged six months to five years, often causing considerable anxiety for caregivers. Understanding their clinical profile and recurrence patterns is essential for effective management.

Aim: To evaluate the clinical characteristics, recurrence patterns, and associated risk factors of febrile seizures in pediatric patients.

Methodology: A retrospective observational study was conducted on 80 children aged 6–60 months presenting with FS at the Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, over six months. Data on demographics, seizure type and duration, fever source, recurrence, and risk factors were analyzed. Simple and complex FS were classified per established guidelines, and recurrence within 24 hours was recorded.

Results: The majority of patients were aged 13–24 months (31.2%) with male predominance (60%). Simple FS accounted for 75% of cases, and most seizures lasted 5–15 minutes. Recurrence within 24 hours occurred in 31.2% of children, predominantly within the first six hours. Male sex and a family history of FS were significant risk factors. Respiratory infections were the most common fever source, and seizures frequently occurred at night (35%).

Conclusion: FS are predominantly simple, brief, and occur in early childhood, with early recurrences influenced by sex and family history. Recognition of risk factors and caregiver education are crucial for optimized management.

Keywords: Febrile seizure, pediatric, recurrence, clinical profile, risk factors.

Introduction

Febrile seizure (FS) is the most prevalent type of seizure disorder in children, and it is mostly common among children aged between six months and five years [1]. FS is characterized as a seizure that is present in the setting of a febrile disease without signs of central nervous system infection or acute metabolic derangement. FS is geographically diverse, with reports of 2-5% prevalence in the United States and Western Europe, and higher rates, 6-11% in countries like Korea and Japan. Although FS is usually benign, the incident can be frightening to the caregivers, who can develop significant anxiety when they observe a seizure in a healthy child. This is also known as the fever phobia and it continues even in parents who have witnessed several FS episodes in their child.

There are three main concerns of healthcare providers regarding the clinical management of FS in the emergency department (ED) [2]. To begin with, it is essential to distinguish between simple FS and seizures that can be symptomatic of severe acute diseases, including bacterial meningitis or acute encephalitis/encephalopathy. Second, FS can be the initial episode of a progressive epilepsy disorder or can predispose to subsequent epileptic episodes.

Third, immediate seizure recurrence during the same febrile illness may occur, which may further complicate parental anxiety and clinical management. These factors require cautious evaluation and risk stratification among children with FS [3].

Febrile seizures are traditionally classified as either simple febrile seizures (SFS) or complex febrile seizures (CFS). Simple FS are generalized, brief (<15 minutes), and occur only once during a 24-hour febrile period. Complex FS, on the other hand, are defined by focal semiology of seizures, long duration (>10 to 15 minutes), or recurrent seizures in 24 hours. Children with CFS may need a more thorough assessment, such as neurodiagnostic testing and potential hospitalization, which is advised in about 42 to 52 percent of first-time CFS cases [4]. Nevertheless, there is an emerging body of evidence that the diagnostic value of routine tests like lumbar puncture (LP), neuroimaging, and urgent electroencephalography (EEG) is not very high, which questions the need of such tests in every situation.

The release of the 2011 American Academy of Pediatrics (AAP) guidelines on SFS was a major change in the treatment of FS. These recommendations focused on the selective application of diagnostic tests and hospitalizations, which resulted in a significant decrease in unnecessary procedures and healthcare expenses, without affecting the timely diagnosis of bacterial meningitis [5]. The incidence of bacterial meningitis in children with FS has further decreased with the widespread use of Haemophilus influenzae type b and pneumococcal vaccines, which are now only found in 0.3 to 0.7% of cases. Invasive procedures like LP should therefore be used in patients with high-risk characteristics, such as complicated presentations or abnormal neurological results, and not as a routine procedure.

While intracranial abnormalities in children with CFS are rare, neuroimaging may be warranted in cases with focal neurological deficits or atypical features [6]. The risk of later epilepsy in children with CFS is estimated to be 6-8 percent, with increased risks in children with focal features (6.3 percent) or long seizure times (29.4 percent). Conversely, FS recurrence in 24 hours seems to have the least risk (3.6 percent) of developing epilepsy. The predictive value of interictal EEG in the future of epilepsy is controversial and has little influence on the acute treatment of FS.

Since FS is common and both parents and clinicians have concerns about it, it is important to know the clinical profile and recurrence patterns of FS to maximize patient care and counseling families [7]. Although there is a lot of research, there are still gaps in the description of risk factors of recurrence and progression to epilepsy, especially in the case of complex febrile seizures. An in-depth analysis of FS presentations, seizure features, and outcomes can guide clinical decision-making, minimize unnecessary interventions, and improve parental education about the benign nature of the majority of FS episodes.

The purpose of the study is to explore the clinical presentation and recurrence of febrile seizures in children, which will shed light on the patterns, risk factors, and clinical implications of this prevalent pediatric neurological condition. This study aims to elucidate the clinical spectrum of FS, recurrence probability, and possible development of epilepsy by examining simple and complex FS presentations, which will help in evidence-based care practices and informed counseling of caregivers.

Methodology

Study Design: This study was designed as a retrospective observational cohort study to evaluate the clinical profile and recurrence of febrile seizures (FS) in pediatric patients. The study aimed to assess demographic characteristics, seizure patterns, recurrence rates, and potential risk factors associated with FS in children.

Study Area: The study was conducted at the Department of Pediatrics, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

Study Duration: The duration of the study was six months from March 2025 to August 2025.

Study Participants

Inclusion Criteria

- Children aged six months to 60 months presenting with febrile seizures.
- Patients diagnosed with FS based on clinical criteria: a seizure associated with fever (≥38°C) without evidence of central nervous system infection or metabolic abnormalities.
- Patients with documented hospitalization or emergency department visits for FS.

Exclusion Criteria

- Children with pre-existing neurological conditions, such as epilepsy or prior seizures unrelated to fever.
- Children with metabolic disorders, chromosomal abnormalities, or intracranial lesions, including brain tumors, hydrocephalus, or traumatic brain injury.
- Patients presenting with focal seizures, seizures lasting more than 15 minutes, or abnormal neurological examination findings.
- Patients with incomplete or missing medical records.

Sample Size: The study included a total of 80 pediatric patients who met the inclusion criteria.

Procedure: Medical records of pediatric patients presenting with FS were reviewed retrospectively. Data collected included demographic details such as age, sex, and family history of FS or epilepsy, as well as clinical features including type and duration of seizures, body temperature during seizure

episodes, recurrence, and time intervals between fever onset and seizure occurrence. Seizure classification was based on established guidelines: simple febrile seizures (SFS) were generalized seizures lasting less than 15 minutes with no recurrence within 24 hours, while complex febrile seizures (CFS) were defined as focal, prolonged (>15 minutes), or recurrent within 24 hours. Recurrence was noted if additional seizures occurred within 24 hours following the initial event. For recurrent cases, detailed clinical data including the interval between episodes, seizure duration, and associated comorbidities were recorded. Standard pediatric protocols for FS management were also noted, including fever control, hospitalization for CFS, and neurodiagnostic evaluation such as EEG and neuroimaging when indicated.

Statistical Analysis: All collected data were entered and analyzed using SPSS version 27.0. Continuous variables were assessed for normality using the Kolmogorov-Smirnov test. Normally distributed variables were expressed as mean ± standard deviation (SD) and compared using the Student's t-test, while non-normally distributed variables were presented as median and interquartile range and compared using the Mann-Whitney U test. Categorical variables were expressed as frequencies and percentages and compared using the chi-square test or Fisher's exact test, as appropriate. Logistic regression analysis was conducted to identify potential risk factors for FS recurrence. Variables with $P < 0.1$ in univariate analysis were included in the multivariate model using backward elimination, and adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. Statistical significance was set at $P < 0.05$.

Result

Table 1 presents the demographic characteristics of the 80 pediatric patients included in the study. The age distribution shows that the largest group of patients fell within 13–24 months, accounting for 25 children (31.2%), followed by those aged 25–36 months with 18 children (22.5%). Children aged 6–12 months comprised 15 (18.8%), those 37–48 months were 12 (15%), and the smallest group, 49–60 months, included 10 children (12.5%). Regarding sex distribution, males predominated with 48 children (60%), while females represented 32 children (40%). This indicates a slightly higher prevalence of male patients and a concentration of cases in the second year of life.

Table 1: Demographic Characteristics of Pediatric Patients (n = 80)

Characteristic	Number (n)	Percentage (%)
Age (months)		
6–12	15	18.8
13–24	25	31.2
25–36	18	22.5
37–48	12	15
49–60	10	12.5
Sex		
Male	48	60
Female	32	40

Table 2 presents the clinical features of febrile seizures among 80 pediatric patients. The majority of cases were simple febrile seizures (SFS), accounting for 60 patients (75%), while complex febrile seizures (CFS) were observed in 20 patients (25%). Regarding seizure duration, 35 children (43.8%) experienced seizures lasting less than 5 minutes, whereas 45 children (56.2%) had seizures lasting between 5 and 15 minutes. Analysis of body temperature at the time of seizure revealed that 28 children (35%) had temperatures between 38.0–38.9°C, 36 children (45%) between 39.0–39.9°C, and 16 children (20%) had temperatures of 40.0°C or higher, indicating a higher proportion of febrile seizures occurred at moderate fevers.

Table 2: Clinical Features of Febrile Seizures (n = 80)

Clinical Feature	Number (n)	Percentage (%)
Type of FS		
Simple FS (SFS)	60	75
Complex FS (CFS)	20	25
Duration of Seizure		
< 5 min	35	43.8
5–15 min	45	56.2
Body Temperature at Seizure (°C)		
38.0–38.9	28	35
39.0–39.9	36	45
≥40.0	16	20

Table 3 shows the recurrence pattern of febrile seizures within 24 hours among 80 pediatric patients. The majority of children, 55 (68.8%), did not experience any recurrence, while 20 children (25%) had 1–2 recurrent episodes, and a smaller group of 5 children (6.2%) experienced more than 2 episodes. Considering the timing of recurrence, 12 children (15%) had a second seizure within the first 6 hours, 8 children (10%) experienced recurrence between 6–12 hours, and 5 children (6.2%) had seizures occurring between 12–24 hours after the initial episode. This indicates that most recurrences tend to occur early, within the first 6 hours, and the majority of patients did not have repeated seizures within the 24-hour period.

Table 3: Recurrence of Febrile Seizures within 24 Hours (n = 80)		
Recurrence	**Number (n)**	**Percentage (%)**
No recurrence	55	68.8
Recurrence (1–2 episodes)	20	25
Recurrence (>2 episodes)	5	6.2
Time interval from first seizure (hours)		
<6	12	15
6–12	8	10
12–24	5	6.2

Table 4 presents the distribution of family history and other risk factors among the 80 pediatric patients studied. A family history of febrile seizures was observed in 18 children, accounting for 22.5% of the sample, while 6 children (7.5%) had a family history of epilepsy. Male children constituted the majority with 48 cases (60%). Age under 12 months was noted in 15 patients (18.8%), and low serum sodium levels (<135 mEq/L) were present in 10 children (12.5%). These findings suggest that male sex and family history of febrile seizures were the most common risk factors in this cohort.

Table 4: Family History and Risk Factors (n = 80)		
Risk Factor	**Number (n)**	**Percentage (%)**
Family history of FS	18	22.5
Family history of epilepsy	6	7.5
Male sex	48	60
Age <12 months	15	18.8
Low serum sodium (<135 mEq/L)	10	12.5

Table 5 illustrates the distribution of fever sources and the timing of seizures among 80 pediatric patients. The majority of fevers were attributed to respiratory tract infections, accounting for 32 cases (40%), followed by gastrointestinal infections in 18 patients (22.5%), urinary tract infections in 6 patients (7.5%), and 24 cases (30%) with unknown or other causes. Regarding seizure timing, most episodes occurred at night between 00:00 and 05:59, involving 28 children (35%), while 22 seizures (27.5%) occurred in the afternoon, 16 (20%) in the evening, and 14 (17.5%) in the morning, indicating a higher frequency of febrile seizures during nighttime hours.

Table 5: Sources of Fever and Seizure Timing (n = 80)		
Feature	**Number (n)**	**Percentage (%)**
Source of Fever		
Respiratory tract infection	32	40
Gastrointestinal infection	18	22.5
Urinary tract infection	6	7.5
Unknown/Other	24	30
Seizure Timing		
Night (00:00–05:59)	28	35
Morning (06:00–11:59)	14	17.5
Afternoon (12:00–17:59)	22	27.5
Evening (18:00–23:59)	16	20

Discussion

The present study results support existing research that shows high rates of febrile seizures which medical research shows peaks in children aged 12 to 24

months. The 80 pediatric patients in our study showed that most febrile seizures occurred when children reached their second year of life, which matched previous research that identified this age period as the most dangerous time for febrile seizures (Shang et al., 2018) [8]. The 60% male predominance we observed matches results from multiple studies which found that boys experience higher rates of febrile seizures than girls, indicating that male sex functions as an unchangeable risk factor because genetic and developmental differences affect this condition (Choi et al., 2019) [9]. The demographic pattern shows that early childhood and male sex function as common characteristics which health officials use to identify people who experience febrile seizures, but research studies show different degrees of male-female ratio imbalance.

The study found that simple febrile seizures (SFS) made up 75% of the total cases while complex febrile seizures occurred less frequently. The existing research demonstrates that simple febrile seizures represent the most common seizure type according to multiple extensive cohort studies, which describe this seizure type as having generalized symptoms that last for a brief period and lead to positive medical results (American Academy of Pediatrics, 2008) [10]. The study found that SFS cases made up about 60 to 70 percent of our research, which showed a higher SFS proportion than previous studies because different clinical definitions and referral patterns affected our results (Olson et al., 2018) [11]. The results show that SFS cases most commonly occur in pediatric emergency rooms because of their high occurrence within that medical setting.

The study centered on studying how seizures return after their first occurrence. The study discovered that 24.8% of patients developed recurrent SFS, with most patients showing their first seizure recurrence through their first six hours. The study results show that this higher early recurrence rate exceeds previous research, which documented 15–16% of patients experiencing recurrence within 24 hours (Inoue et al., 2020; Berg & Shinnar, 1996) [12,13]. The early recurrence rate in our group shows that this rate depends on different population traits and different approaches to emergency health care, which include distinct hospital admission criteria and social customs that push people to seek immediate health care. The research shows that second seizures mostly happen during the first hours, which matches Japanese single center studies that demonstrate over 80% of recurrences occur during the initial period of the same febrile illness (Inoue et al., 2020). The two observations show that the crucial postictal period needs to be used for monitoring patients and providing them with medical support.

The study found that male sex together with family history of febrile seizures functioned as main risk factors for recurrence while the results confirmed established links which earlier studies had documented. The genetic predisposition of an individual serves as the most accurate prediction method for determining their chances of experiencing febrile seizures which family history increases according to research findings by Choi et al. The study found that patients who showed body temperature below 39°C at their first assessment had a higher chance of experiencing early recurrence. The particular finding shows that people who experience seizures with lower peak fever during their seizure show lower seizure thresholds due to their specific brain vulnerability (El Radhi, 1998) [14]. The research shows that different studies have found inconsistent results about sodium levels and age below 12 months as common factors that predict outcomes showing how different populations react to risk factors which necessitates specific methods for assessing dangers in each situation.

Our study discovered that respiratory tract infections serve as the primary cause of fever which leads to seizures while gastrointestinal and urinary infections follow as secondary sources. The pattern of febrile seizures shows that common childhood infections which cause fever lead to respiratory sicknesses which Smith et al. established in 2019 [15]. The previous studies showed that upper respiratory tract infections frequently trigger seizures but different studies showed that certain groups had higher gastrointestinal triggers which depended on their regional disease patterns and vaccination practices. The study found that respiratory infections constitute a major health risk which makes it essential to identify febrile conditions that present respiratory symptoms as potential seizure triggers in children who already have susceptibility.

The temporal pattern observed in our study, with more seizures occurring during nighttime hours between midnight and early morning, reflects emerging evidence that circadian rhythms may influence febrile seizure occurrence. The available studies on diurnal seizure patterns have found that people experience an increased risk of febrile seizures during periods of sleep because their body temperature and neuronal activity follow circadian rhythms (Sharafi et al., 2017) [16]. Our findings show this trend but researchers need to conduct more studies to determine whether the observed patterns show inherent brain disorder vulnerabilities or result from the combination of sleep patterns and body temperature changes during febrile illness.

The current study confirms existing research through its clinical data and recurrence rates which show similar results to the previous studies. The early recurrence rate of our cohort displays a higher rate than typical because it requires research to determine what specific factors affect different populations and how they respond to immediate treatment. The comparative findings demonstrate that

although febrile seizures typically show harmless symptoms, they present different medical patterns which require specific care for patients and their caregivers.

Conclusion

This study highlights those febrile seizures predominantly affect children between 13 and 24 months, with a slight male predominance, and those simple febrile seizures remain the most common type. Most seizures were brief and associated with moderate fevers, and recurrence within 24 hours occurred in approximately one-third of patients, with the majority of repeated episodes occurring within the first six hours. Male sex and a positive family history of febrile seizures emerged as significant risk factors, while respiratory infections were the most frequent fever source. Nighttime occurrence was common, suggesting possible circadian influences. Overall, these findings reinforce those febrile seizures are largely benign but emphasize the importance of early monitoring, identification of risk factors, and caregiver education to optimize management and reduce parental anxiety.

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