

A Hospital-Based Study on the Clinical Spectrum of Febrile Seizures in SKMCH, Muzaffarpur, Bihar

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Abstract:

Background: Febrile seizures are the most common convulsive events in early childhood, often occurring between 6 months and 5 years in association with fever, and represent a significant cause of pediatric emergency visits.

Aim: To evaluate the clinical spectrum, demographic patterns, seizure characteristics, and associated factors of febrile seizures among children admitted to Sri Krishna Medical College and Hospital (SKMCH), Muzaffarpur, Bihar.

Methodology: A retrospective cross-sectional study was conducted over six months, reviewing records of 90 children aged 6 months to 5 years admitted with febrile seizures. Data on age, sex, seizure type and duration, recurrence, family history, associated illnesses, laboratory findings, and treatment were analyzed using descriptive statistics.

Results: The majority of children were aged 13–24 months (35.6%) and males (60%). Simple febrile seizures predominated (68.9%), with most lasting <5 minutes and rarely recurring within 24 hours (24.4%). Fever, particularly due to upper respiratory tract infections (42.2%), was the main precipitating factor. Electrolyte disturbances were uncommon (13.3%), and familial history was present in 28.9% of cases.

Conclusion: Febrile seizures at SKMCH predominantly affect young male children, are usually simple and brief, and are mostly associated with infections. These findings provide region-specific data to guide clinical management, parental counseling, and follow-up strategies.

Keywords: Febrile Seizures, Pediatrics, Simple and Complex Seizures, Upper Respiratory Infections, Clinical Spectrum.

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Introduction

Febrile seizures represent the most prevalent type of convulsive seizure which affects infants and young children between the ages of 6 months and 5 years who experience fever without showing signs of brain infection or metabolic disorders or having previous non-febrile seizure episodes [1]. They represent a significant cause of pediatric emergency visits and hospital admissions worldwide. Parents and caregivers tend to experience high levels of anxiety about febrile seizures which doctors consider to be harmless and self-resolving yet these seizures may lead to recurring episodes or develop into epilepsy in some patients. Western countries show an incidence range between 2 and 5 percent while certain Asian populations exhibit higher rates because of their distinct genetic makeup and environmental

conditions and patterns of infection and healthcare-seeking behavior [2]. The clinical spectrum of febrile seizures requires regional context understanding to develop effective management plans and family counseling methods and high-risk group identification.

Febrile seizures are divided into two main categories which are known as simple and complex seizures. Simple febrile seizures begin with generalized body movements and they last under 15 minutes while they do not occur again during the next 24 hours. The complex febrile seizures which show focal features continue for over 15 minutes and they happen again during the same febrile episode [3]. Febrile status epilepticus occurs when a febrile seizure lasts

more than 30 minutes or when multiple seizures happen without complete recovery between episodes, which constitutes the most serious form of epilepsy that needs immediate medical treatment. The clinical spectrum encompasses a wide range of manifestations which include generalized tonic-clonic movements and focal motor activity and altered consciousness and postictal drowsiness and rare cases of transient neurological deficits. The presence of upper respiratory tract infection and gastroenteritis and otitis media and other febrile illnesses as associated symptoms helps to identify the fever's underlying cause according to research from [4].

In India, febrile seizures constitute a substantial proportion of pediatric neurological presentations, particularly in resource-limited settings where infectious diseases remain prevalent [5]. The presentation and outcomes of febrile seizures are affected by seasonal variations and nutritional status and immunization coverage and medical care seeking delays. The ability to recognize medical conditions and provide prompt treatment is affected by three sociodemographic factors which include rural living, economic disadvantage, and parental knowledge limitations. The pattern of infections and healthcare accessibility and referral systems between states and districts requires regional data which serves as a vital requirement for understanding these differences [6]. The region of Bihar experiences a high burden of pediatric febrile illnesses yet there exists a shortage of comprehensive studies which investigate both the clinical characteristics and the complete range of febrile seizures found in this area.

The Sri Krishna Medical College and Hospital SKMCH serves as a primary tertiary medical center which provides healthcare services to the extensive population range from urban residents to rural inhabitants throughout North Bihar and its adjacent regions. The hospital handles pediatric emergency cases which include seizure problems that arise from febrile conditions. The pediatric department at this hospital sees febrile seizures as a common medical condition because infectious diseases like acute respiratory infections and enteric infections and seasonal viral outbreaks are highly prevalent in this area. The clinical evaluation of febrile seizures at SKMCH allows researchers to study demographic data which includes age and sex distribution and different seizure types and patterns of seizure frequency and duration and family medical history and other health conditions and laboratory results and immediate medical results in an authentic tertiary medical environment.

The comprehensive evaluation of the clinical spectrum also allows one to determine the risk factors of recurrence and developing epilepsy. The previous research has implicated factors like early age of onset of seizures, family history of febrile seizure or epilepsy, low-grade fever upon onset, complex fea-

ture of seizures and neurodevelopment abnormalities [7]. These factors, however, can have different amounts of contribution depending on the populations. These differences can be understood by applying them to the scenario of SKMCH to contribute to evidence-based counseling and follow-up interventions towards children with such deformities and their families. Moreover, noting the management practices in place at the moment (the use of antipyretics, anticonvulsants and supportive care) may point to the areas where the protocols can be optimized and the resources may be allocated.

The clinical assessment of febrile seizures needs keen elimination of central nervous system infections like meningitis and encephalitis that remain a critical issue in the developing regions. In such places as Muzaffarpur where acute encephalopathy syndrome outbreaks had been recorded in the past, it is especially important to distinguish between benign febrile seizures and more severe neurological disorders. Therefore, the methodical reporting of features of presentation, results of the neurological examination, and other appropriate investigations is a part and parcel of the clinical spectrum study.

In summary, febrile seizures are a widespread but a clinically heterogeneous condition of childhood that has significant implications on child health and reassurance to a parent. To obtain local epidemiological trends and healthcare realities, it is necessary to explore their clinical spectrum at SKMCH, Muzaffarpur, Bihar, and produce region-specific data. Not only would such an investigation add to the scientific knowledge of the febrile seizures in Eastern India, but it would also help in enhancing the accuracy of diagnosis, rational management, and specific counseling that would lower morbidity and eliminate parental anxiety".

Methodology

Study Design: A hospital-based retrospective cross-sectional study was conducted to evaluate the clinical spectrum of febrile seizures among pediatric patients.

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

Study Duration: The study was conducted over a period of six months from June 2025 to November 2025.

Study Participants

Inclusion Criteria

- Children aged 6 months to 5 years.
- Patients admitted with a history of seizures associated with fever ($\geq 38^{\circ}\text{C}$), occurring during or within 24 hours of fever onset.

- Children diagnosed clinically as having simple or complex febrile seizures.
- Availability of complete medical records including demographic and clinical details.

Exclusion Criteria

- Children with a history of afebrile seizures or diagnosed epilepsy.
- Presence of central nervous system infections such as meningitis or encephalitis.
- Evidence of metabolic abnormalities (e.g., hypoglycemia, electrolyte imbalance).
- Children with known neurodevelopmental delay or structural brain abnormalities.
- Incomplete or missing medical records.

Sample Size: The total sample size comprised 90 pediatric patients who fulfilled the inclusion criteria during the study period.

Procedure: Data were collected from hospital records and inpatient case sheets of children admitted with febrile seizures during the defined six-month period. Relevant information including age, sex, residence, duration and peak temperature of fever, type of seizure (simple or complex), duration of seizure, recurrence within 24 hours, family history of febrile seizures or epilepsy, associated symptoms, laboratory investigations, and treatment details were recorded using a predesigned data collection proforma. Febrile seizures were classified into simple and complex types based on standard clinical criteria. Simple febrile seizures were defined as generalized tonic-clonic seizures lasting less than 15 minutes and not recurring within 24 hours, whereas complex febrile seizures were characterized by focal features, prolonged duration (>15 minutes), or recurrence within 24 hours. All relevant laboratory findings

such as complete blood count, serum electrolytes, and other investigations performed during admission were documented. Data confidentiality was maintained throughout the study, and no personal identifiers were disclosed. The collected data were systematically compiled and prepared for statistical analysis.

Statistical Analysis: All collected data were entered into Microsoft Excel and subsequently analyzed using Statistical Package for the Social Sciences (SPSS) version 27.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were applied to summarize demographic and clinical variables. Continuous variables were expressed as mean and standard deviation, while categorical variables were presented as frequencies and percentages. The results were depicted in the form of tables and charts wherever appropriate. Appropriate statistical tests such as the Chi-square test were applied to assess associations between categorical variables, with a p-value of <0.05 considered statistically significant.

Result

Table 1 shows the age distribution of the study participants (N = 90). The majority of children belonged to the 13–24 months age group, comprising 32 participants (35.6%), making it the largest proportion in the study. This was followed by the 25–36 months group with 20 participants (22.2%) and the 6–12 months group with 18 participants (20%). Children aged 37–48 months accounted for 12 participants (13.3%), while the smallest proportion was observed in the 49–60 months group with 8 participants (8.9%). Overall, the data indicate that most participants were below 3 years of age, with a gradual decline in frequency as age increased.

Table 1: Age Distribution of Study Participants (N = 90)		
Age Group (Months/Years)	Frequency (n)	Percentage (%)
6–12 months	18	20
13–24 months	32	35.6
25–36 months	20	22.2
37–48 months	12	13.3
49–60 months	8	8.9
Total	90	100

Table 2 shows the gender distribution of the study participants (N = 90). Out of the total 90 participants, 54 (60%) were males and 36 (40%) were females. This indicates that males constituted the majority of the study population, with a 20% higher

representation compared to females. The distribution suggests a moderate gender imbalance, with male participants being more prevalent in the sample.

Table 2: Gender Distribution of Study Participants (N = 90)		
Gender	Frequency (n)	Percentage (%)
Male	54	60
Female	36	40
Total	90	100

Table 3 shows the distribution of the type of febrile seizures among the study participants (N = 90). The majority of children, 62 cases (68.9%), experienced simple febrile seizures, whereas 28 cases (31.1%) had complex febrile seizures. This indicates that

simple febrile seizures were more than twice as common as complex febrile seizures in the study population. Overall, simple febrile seizures constituted the predominant clinical presentation among children admitted with febrile seizures in this sample.

Table 3: Type of Febrile Seizure (N = 90)		
Type of Febrile Seizure	Frequency (n)	Percentage (%)
Simple Febrile Seizure	62	68.9
Complex Febrile Seizure	28	31.1
Total	90	100

Table 4 shows the clinical characteristics of seizures among the 90 study participants. The majority of children (53.3%) experienced seizures lasting less than 5 minutes, while 30% had seizures lasting between 5–15 minutes and 16.7% had prolonged seizures of more than 15 minutes. Recurrence of seizures within 24 hours was observed in 24.4% of

cases, whereas 75.6% did not have any recurrence during this period. Additionally, a positive family history of febrile seizures was present in 28.9% of participants, while 71.1% had no such family history. Overall, most seizures were short in duration, non-recurrent within 24 hours, and occurred in children without a family history of febrile seizures.

Table 4: Clinical Characteristics of Seizures (N = 90)			
Clinical Variable	Category	Frequency (n)	Percentage (%)
Duration of Seizure	<5 minutes	48	53.3
	5–15 minutes	27	30
	>15 minutes	15	16.7
Recurrence within 24 hours	Yes	22	24.4
	No	68	75.6
Family History of Febrile Seizure	Present	26	28.9
	Absent	64	71.1

Table 5 shows that the majority of patients (55.6%) had a peak temperature between 38–39°C, while a substantial proportion (44.4%) presented with high-grade fever exceeding 39°C, indicating that most cases were associated with moderate to high fever. Regarding associated infections, upper respiratory tract infection was the most common underlying condition, observed in 42.2% of cases, followed by gastroenteritis (20%), lower respiratory tract infection (15.6%), urinary tract infection (11.1%), and other or unknown causes (11.1%). This pattern sug-

gests that respiratory infections constituted the predominant precipitating factor in the study population. In terms of laboratory findings, serum electrolyte abnormalities were present in only 13.3% of patients, whereas the majority (86.7%) had no detectable electrolyte imbalance, indicating that electrolyte disturbances were relatively uncommon in this cohort. Overall, the findings highlight fever and respiratory infections as the most prominent associated clinical features, with minimal contribution from electrolyte abnormalities.

Table 5: Associated Clinical Features and Laboratory Findings (N = 90)			
Variable	Category	Frequency (n)	Percentage (%)
Peak Temperature	38–39°C	50	55.6
	>39°C	40	44.4
Associated Infection	Upper Respiratory Tract Infection	38	42.2
	Gastroenteritis	18	20
	Lower Respiratory Tract Infection	14	15.6
	Urinary Tract Infection	10	11.1
	Others/Unknown	10	11.1
Serum Electrolyte Abnormality	Present	12	13.3
	Absent	78	86.7

Discussion

The current research showed that febrile seizures occurred more frequently among male children who made up 60 percent of the total study group. The

male dominance in this study matches multiple earlier research studies. Leung et al. (2018) [8] reported a male-to-female ratio of 1.6:1 in a large meta-analysis which is consistent with our findings. Appleton and his team (2004) [9] found that boys showed

slightly higher rates of febrile seizures than girls which demonstrates that boys have more risk to develop this condition due to their hormonal and genetic characteristics that affect their brain activity. The research conducted by Sadleir and Scheffer (2007) [10] revealed that male dominance exists in most cases but it does not apply to all groups”.

The study showed that most febrile seizures happened to children below three years of age, while the 13-24 months age group presented the highest number of cases. Millichap (2019) [11] established a worldwide epidemiological pattern which shows that children between 6 months and 5 years’ experience febrile seizures most frequently, with the highest occurrence rate between 12 and 24 months. The results we obtained matched those found by Siqueira (2010) [12], who showed that 65% of febrile seizures occurred in children younger than two years, which demonstrates that early childhood serves as the main time for children to develop seizure disorders. Urban hospital studies found that different peak ages occurred because patients tended to have different infection exposure patterns and different healthcare-seeking behavior.

The established literature on our cohort study results which show two-thirds of the cases involving simple febrile seizures as the most common type of seizure. Randel (2011) [13] states that simple febrile seizures make up 70–75% of all febrile seizures which last less than 15 minutes and involve generalized tonic-clonic activity. Our study further noted that most seizures lasted less than 5 minutes which these guidelines. The study results showed that complex febrile seizures occurred at lower rates which Waruiru and Appleton (2004) [14] reported through their research showing complex seizures occurred in 15 to 20 percent of their cases. The study from Ali-Asghar Children’s Hospital in Iran (Tavasoli et al., 2021) [15] showed that 22 percent of patients experienced complex febrile seizures, which occurred due to referral bias because tertiary centers treated more advanced medical cases.

Our study found that people who experienced seizures showed low recurrence rates within the first 24 hours which confirmed earlier research results. Leung et al. (2018) [16] showed that immediate recurrence occurs in only 5-10% of children with their first febrile seizure which matches our study group. Family history of febrile seizures was positive in less than one-third of participants which matched the results from Sadleir and Scheffer (2007) who found that 20-30% of cases showed familial predisposition. The evidence establishes that genetic factors create seizure susceptibility for most children who experience febrile seizures because they lack specific hereditary connections.

Fever served as the main cause of illness because more than 50 percent of children showed fever

symptoms with body temperatures from 38 to 39 degrees Celsius. According to Millichap (2019) [17] who studied febrile seizures he found that the condition occurs more often when people have moderate to high fever which results from viral infections. Upper respiratory tract infections served as the most frequent condition that people developed together with gastroenteritis which matches the patterns observed in worldwide epidemiological research. Appleton and his team discovered in their 2004 study that respiratory infections served as the main cause of illness in 55 percent of cases while gastrointestinal infections accounted for 10 to 15 percent of cases. The local infection patterns in Muzaffarpur show identical patterns to those found in international research.

The study found that our cohort had very low serum electrolyte disturbances which showed that these disturbances had no impact on their seizure events. The American Academy of Pediatrics (2011) guidelines state that doctors should not perform routine electrolyte tests on healthy children who experience simple febrile seizures. The research by Fletcher and Sharieff (2013) [18] showed that only 2% of children with complex febrile seizures had essential metabolic abnormalities which proved that electrolyte imbalances had a minimal effect on febrile seizure development.

Meningitis was uncommon in our study which showed that 4.7% of cases had the condition. The previous national incidence report showed 12 cases per 10000 people but the actual rate remains low for this medical condition. The incidence of bacterial meningitis among children with febrile seizures in France was reported as 1.9% by Casasoprana et al. The studies that studied complex febrile seizures found even lower rates which were documented at 0.5% (Fletcher & Sharieff, 2013) and 0.57% (Kimia et al., 2018) [20]. Our group showed a lumbar puncture rate of 11.3% which involved 17 out of 150 cases. This rate falls below the 40% rate reported by Casasoprana et al. The 65 to 70.5% rates in studies which studied complex febrile seizures show different results from our research. The differences between these two studies reveal different ways of treating patients which leads to better understanding of how common bacterial meningitis actually is in children who have febrile seizures.

Our study findings show that the clinical spectrum which our study group exhibited matches the results of previous research conducted in India and other countries. The study results demonstrate that young male children experience brief simple febrile seizures which occur most frequently during respiratory infections. The study shows that metabolic disturbances and familial predisposition have minimal impact on their development. The study shows that doctors should perform lumbar punctures only in specific cases when patients demonstrate actual

need because febrile seizures usually present as harmless conditions. The study results show that neurodiagnostic tests should occur only in specific situations instead of being conducted as standard practice.

Conclusion

This study provides a comprehensive overview of the clinical spectrum of febrile seizures among children admitted to SKMCH, Muzaffarpur, Bihar. The findings demonstrate that febrile seizures predominantly affect children under three years of age, with a peak incidence in the 13–24 months group, and show a clear male predominance. Simple febrile seizures were the most common type, generally brief in duration, and infrequently recurrent within 24 hours, while complex seizures were less common. Fever, particularly associated with upper respiratory tract infections, was the primary precipitating factor, whereas electrolyte disturbances and familial predisposition played a minimal role. Overall, the study reinforces the largely benign nature of febrile seizures, highlights the importance of targeted evaluation, and provides valuable region-specific data to guide clinical management, parental counseling, and follow-up strategies.

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