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Original Research Article

# Clinical and Etiological Profile of Children with Atypical Febrile Seizures Aged 6 Months to 5 Years: A Hospital-Based Observational Study

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**Abstract:**

**Background:** Atypical (complex) febrile seizures differ from simple febrile seizures due to features like prolonged duration, focality, or recurrence, and may indicate underlying pathology. Data from developing regions remain limited.

**Aim:** To evaluate the clinical and etiological profile of children aged 6 months to 5 years presenting with atypical febrile seizures.

**Methodology:** This prospective hospital-based observational study was conducted over 7 months in Department of Pediatrics, Government Medical College and Hospital, Bettiah, Bihar, India. A total of 70 children meeting inclusion criteria were enrolled. Clinical details, risk factors, and relevant investigations were recorded and analyzed using descriptive statistics.

**Results:** Males predominated (68.57%), and most children were >1 year (74.29%). The most common atypical feature was recurrence within 24 hours (94.29%), followed by prolonged seizures (14.29%) and focal seizures (8.57%). Key risk factors included short fever duration (<24 hours, 64.29%), moderate fever (45.71%), male gender (68.57%), and hyponatremia (20%). Meningitis was identified in 21.43% of cases.

**Conclusion:** Atypical febrile seizures show diverse clinical patterns, with recurrence being most common. Significant risk factors and notable meningitis prevalence highlight the need for careful evaluation and monitoring.

**Keywords:** Atypical febrile seizures, complex febrile seizures, children, meningitis, risk factors, recurrence



## Introduction

A febrile seizure is a type of seizure, which happens to be in conjunction with a febrile illness when there is no infection of the central nervous system or acute electrolyte deficiency in children. Febrile seizures are the most prevalent neurological disease in the pediatric group with an estimated prevalence of 2 -5 percent in the global population of children [1]. These seizures are usually observed in children aged between 6 months and 5 years old with their highest incidence observed between the ages of 12 and 18 months. Although they are usually benign, febrile seizures can be associated with a significant level of anxiety among caregivers and parents and result in numerous emergency hospital visits and complicated clinical examinations.

The febrile seizures are broadly divided into two, simple febrile seizures and complex febrile seizures. Simple febrile seizures are found in otherwise healthy children, they are generalized tonic-clonic, of less than 15 minutes in duration, and never recur within 24 hours. Conversely, complex febrile seizures are marked by focal onset or characteristics, extended by one longer than 15 minutes, or recurrence within 24 hours [2]. Atypical febrile seizures may also be referred to as complex febrile seizures and include manifestations which are not the typical benign pattern of simple febrile seizures. Such unusual manifestations are clinically of more concern because of the possibility of underlying neurological defects, increased risk of relapse and even the development of epilepsy [3].

Febrile seizures have a complex etiopathogenesis that is not fully understood. It is supposed to be a mixture of genetic nature, underdeveloped brain and external stimulus like fever. The mere presence of fever, irrespective of its cause, is a precipitating factor because it decreases the seizure threshold of susceptible children. Some of the most prevalent causes

of febrile illnesses related to seizures include viral infections especially those of the upper respiratory and gastrointestinal tracts [4]. The other causes can be excessive increase of body temperature, a family history of febrile convulsions or epilepsy, and some nutritional deficiencies like iron deficiency anemia.

Febrile seizures are usually not viewed as harmful, but atypical or complex febrile seizures should attract more intensive clinical consideration. Such cases tend to undergo thorough assessment to eliminate serious underlying conditions like infection of the central nervous system, structural abnormalities of the brain or metabolic imbalance. Also, children with atypical febrile seizures have a relatively increased risk to develop epilepsy in later life than those with simple febrile seizures [5]. Knowledge of clinical and etiological profile of such cases is as such essential in making proper diagnosis, management, and counseling of the caregivers [6].

In the past decades, a lot of studies have been done to investigate the clinical nature and prognosis of febrile seizures. Most of such studies have, however, been majorly on simple febrile seizures as they are more prevalent and relatively harmless [7]. Conversely, there are limited data on atypical febrile seizures, particularly those of developing nations such as India. The inconsistency in clinical presentation, underlying causes, and outcome of atypical febrile seizures make it necessary to conduct region specific studies so as to gain deeper insight into their profile across populations.

Moreover, it is crucial to detect abnormalities during the febrile seizure early to be able to stratify the risk and manage it. Clinical factors include the duration of seizure, its frequency, focality, postictal recovery and other related neurological results, which are critical in making the distinction between simple febrile seizures and atypical seizures [8]. In the select cases, laboratory tests and neuroimaging might be needed to determine the underlying etiologies. Nevertheless, there is still a gap in agreement on the level of assessment required, especially in settings with limited resources.

Even though there is progress in the field of pediatrics neurology, there are still gaps in the knowledge of the atypical febrile seizures, especially regarding their etiological spectrum and clinical outcomes across geographical regions. Majority of the literature available is based on tertiary care units in cities, which may not be a true representation of the case in rural or semi urban individuals. Thus, observational studies that take place in hospitals in these areas are necessary to address this gap in knowledge.

Despite the numerous studies that have been conducted to examine the clinical profile of febrile seizures, majority of them are centered on the simple febrile seizures. The information on the clinical profile of atypical febrile seizures in our country is limited, and the number of studies in this direction done is very small. Considering this, the present study was carried out in Bettiah, Bihar, India, in order to shed some light into the clinical and etiological profile of children aged between 6 months and 5 years in who enlisted with atypical febrile seizures. The proposed study should be included in the body of existing knowledge and could help to present the region-specific data which could assist clinicians to understand, assess, and manage such cases better.

## Methodology

**Study Design:** This study was a prospective hospital-based observational study conducted to assess the clinical and etiological profile of children presenting with atypical febrile seizures. The observational design allowed for systematic recording of clinical features and relevant investigations without any intervention.

**Study Area:** The study was conducted in the Department of Pediatrics, Government Medical College and Hospital, Bettiah, Bihar, India.

**Study Duration:** The study was carried out over a period of 7 months from March 2025 to September 2025.

**Sample Size:** A total of 70 children meeting the inclusion criteria were included in the study. The sample size was based on the number of eligible cases presenting during the study period.

**Study Population:** The study population comprised children aged between 6 months and 5 years who presented to the pediatric emergency department or were admitted to the pediatric ward with atypical febrile seizures. These patients were evaluated for their clinical presentation and underlying etiological factors.

**Data Collection:** Data were collected using a predesigned and structured proforma. Information regarding demographic details such as age and sex was recorded. Clinical details including body temperature at presentation, duration of fever prior to seizure, duration and type of seizure, and frequency of seizures were documented. Relevant history including family history of seizures, previous episodes of febrile seizures, and developmental delay was also noted. A thorough clinical examination was performed, including assessment of head circumference, presence of neurocutaneous markers, and detailed central nervous system examination. Investigations such as serum electrolytes, blood glucose, serum calcium, blood and urine cultures, cerebrospinal fluid analysis, neuroimaging, and electroencephalography were performed whenever clinically indicated, and their results were recorded.

### Inclusion Criteria

- All children aged 6 months to 5 years

- Admitted with a diagnosis of atypical febrile seizure during the study period

**Exclusion Criteria**

- Children with history of head injury
- Children with pre-existing epilepsy already on antiepileptic drugs
- Children with history of neonatal seizures

**Study Procedure:** All eligible children presenting with atypical febrile seizures were initially assessed and stabilized according to standard pediatric emergency protocols. A detailed history was obtained, followed by a comprehensive clinical examination. Relevant investigations were carried out based on clinical judgment. Patients were monitored during their hospital stay for seizure recurrence, response to treatment, and any complications, and all findings were systematically recorded.

**Statistical Analysis:** The collected data were entered into Microsoft Excel and analyzed using descriptive statistical methods. Frequencies and percentages were calculated for various variables, and the results were presented in the form of tables and charts where appropriate."

**Result**

Table 1 shows the gender distribution of the study population. Males constituted the majority with 48 patients (68.57%), while females accounted for 22 patients (31.43%). This indicates a clear male predominance in the occurrence of febrile seizures in this study.

**Table 1: Distribution According to Gender**

| Gender | Number | Percentage |
|---|---|---|
| Male | 48 | 68.57% |
| Female | 22 | 31.43% |

Table 2 shows the age distribution of the study population. The majority of patients were older than 1 year, accounting for 52 cases (74.29%), while 18 patients (25.71%) were less than 1 year of age. This indicates that febrile seizures were more common in children above 1 year in this study.

**Table 2: Distribution According to Age**

| Age | Number | Percentage |
|---|---|---|
| <1 year | 18 | 25.71% |
| >1 year | 52 | 74.29% |

Table 3 presents the clinical features observed among patients. The most common atypical feature was occurrence of more than one seizure within 24 hours, seen in 66 patients (94.29%). Prolonged seizure duration (>15 minutes) was noted in 10 patients (14.29%), while focal seizures were observed in 6 (8.57%). Meningeal signs were also present in 6 patients (8.57%), and abnormal neurological examination findings in 5 (7.14%). Less common features included microcephaly in 4 patients (5.71%), developmental delay in 3 (4.29%), and family history of epilepsy in 8 patients (11.43%). Overall, recurrent seizures within 24 hours were the predominant atypical feature.

**Table 3: Clinical Features**

| Atypical feature | Number | Percentage |
|---|---|---|
| Duration >15 minutes | 10 | 14.29% |
| Focal seizure | 6 | 8.57% |
| >1 seizure in 24 hours | 66 | 94.29% |
| Family history of epilepsy | 8 | 11.43% |
| Developmental delay | 3 | 4.29% |
| Abnormal neurological examination | 5 | 7.14% |
| Meningeal signs | 6 | 8.57% |
| Microcephaly | 4 | 5.71% |

Table 4 presents the risk factors for recurrence of febrile seizures. The most common factor was complex febrile seizures, present in all patients (70, 100%). Duration of fever less than 24 hours was observed in 45 patients (64.29%), followed by male gender in 48 (68.57%). Fever in the range of 38–39°C was seen in 32 patients (45.71%). Age less than 1 year at the first episode was noted in 20 patients (28.57%), while low sodium levels were present in 14 (20%). A family history of febrile seizures was the least common risk factor, seen in 9 patients (12.86%). Overall, multiple clinical and demographic factors were associated with recurrence, with complex seizures being the most prominent.

| Table 4: Risk Factors for Recurrence of Febrile Seizures | | |
|---|---|---|
| **Risk factors for recurrence of febrile seizure** | **Number** | **Percentage** |
| Age <1 year at 1st episode | 20 | 28.57% |
| Duration of fever <24 hours | 45 | 64.29% |
| Fever 38–39°C | 32 | 45.71% |
| Family history of febrile seizures | 9 | 12.86% |
| Complex febrile seizure | 70 | 100% |
| Male | 48 | 68.57% |
| Low sodium | 14 | 20.00% |

Table 5 presents the etiology of meningitis among the study population. Meningitis was present in 15 patients (21.43%), while the majority, 55 patients (78.57%), did not have meningitis. This indicates that although meningitis was identified in a notable proportion of cases, most patients did not have this condition.

| Table 5: Etiology (Meningitis) | | |
|---|---|---|
| **Meningitis** | **Number** | **Percentage** |
| Present | 15 | 21.43% |
| Absent | 55 | 78.57% |

## Discussion

The current research shows most definite male dominance (68.57) in children with atypical febrile seizures, which is in line with the previous literature that indicates that boys are more prone to the condition. Mahyar et al. (2010) [9] noticed that about 66 percent of the children who experienced febrile seizures were men, which is very close to our findings. In the same vein, Ashrafzade et al., (2004) [10] also reported the higher occurrence in the male gender, which proves the hypothesis of potential genetic or hormonal effects that pre-disposes the male children to febrile seizures. Similar findings were observed in other epidemiological research works where male dominance was found to be between 60-70 percent thereby confirming that our findings are within the range of expectations (Al-Eissa et al., 1992; Pal et al., 2003) [11,12]. Nevertheless, other population-based studies have revealed that there is a modest excess in the male population only indicating that gender differences, despite being consistent, might be different according to geographic and genetic backgrounds."

On age distribution, 74.29% of children in our study were above 1 year and 25.71% of children faced seizures before the age of 1 year. This is not very similar but a little less than a report made by Eskandarifar et al., (2012) did which indicated that 35.2 percent of children had their initial febrile seizure during the first year of life [13]. This variability can be due to various differences in the study design or inclusion criteria especially because our study was narrowed down to atypical (complex) febrile seizures. According to the literature, febrile seizure peaks between the ages of 12-24 months, which is the same period of time we observe the higher proportion of cases during the post-infancy period (Mikati & Rahi, 2005) [14]. Therefore, early onset may still be an influential risk factor, albeit not as often as atypical febrile events are after the first year of life as we discovered.

Clinically, the most notable unusual observation in our study was the presence of recurring seizures in a 24-hour period (94.29%), significantly greater than most of the past studies. Recurrence for 24 hours is an established characteristic of complex febrile seizures that had been previously reported, but at lower frequencies (Shinnar & Glauser, 2002) [15]. Our research might have been biased towards the higher proportion because of referral bias occurring in a hospital-based environment, where more severe cases are also likely to present. Additional uncharacteristic aspects like an extended period (>15 minutes) in 14.29% and focal seizures in 8.57% are similar to the observations of other previous research, where the extent of prolonged seizures was 1020% and the extent of focus was 510% (Raju & Parvathy, 2020) [16]. These similarities suggest that the clinical spectrum that we have seen in our cohort is, in large part, in line with existing trends of atypical febrile seizures.

Our study had 12.86% family history of febrile seizures, which is relatively low as compared to previous research that reported a range between 20 to 40% (Pal et al., 2003) [12]. This difference can imply either the underreporting or the decreased genetic contribution in our population. On the same note, history of epilepsy among relatives has been reported in 11.43% of the cases as compared to earlier studies showing that there is a small positive relationship between epilepsy and febrile seizures. Our study indicates relatively low familial aggregation which is in contrast with certain Western data, which may indicate ethnic or environmental differences in genetic predisposition.

In our study, hyponatremia appeared in 20 percent, which is similar to 18.75% reported in the specified

discussion but, at the same time, lower than 37.5 percent reported by Kumar et al. (2019) [17]. This difference indicates that on the one hand, hyponatremia is a well-known risk factor of febrile seizures; on the other hand, its rates vary depending on the nutrition status, hydration habits, and healthcare-related factors in the region (Kumar et al., 2019) [17]. Still, the results of our study can confirm the relationship between low sodium levels and elevated risks of complex febrile seizures in accordance with earlier studies.

A noteworthy finding during our research was that 64.29 percent of children suffered a seizure within 24 hours of a fever onset which corresponds to the existing literature that febrile seizures tend to happen early during febrile illness (Mikati & Rahi, 2005) [14]. Moderate-grade fever (38 39 o C) was also found to be a predisposing factor in 45.71% of cases which lends credibility to the idea that the rapid increase in temperature instead of the absolute maximum could be a decisive provocation. These results are in line with previous works that focus on the time and dynamics of the fevers as the detectable factors in the precipitation of seizures as opposed to severity itself.

In terms of etiology, we found meningitis in 21.43 percent of cases which is significantly greater than 2-5 percent in a series of previous studies (Jaffe et al., 1981; McLntyre et al., 1990) [18,19] . Nonetheless, our result is similar to Green et al., (1993) [20] who indicated that about 23 percent of the children with febrile seizures were initially diagnosed as meningitis. The increased percentage in our research might be explained by the conservative clinical measures and the incorporation of cases with the abnormalities of the CSF like pleocytosis or high-protein levels. Notably, just like in the past, seizures were not very often the only manifestation of meningitis, and the majority of cases were accompanied by other clinical manifestations. This is an indication that close assessment is necessary to exclude the case of central nervous system infection among children with atypical febrile seizures.

Generally, in our research, the results are mostly in agreement with available literature, especially on the aspect of the male dominance, age distribution, and significant clinical characteristics. Nevertheless, some variations, including a higher rate of recurrent seizures within 24 hours of time and higher percentage of suspected meningitis, highlight the role of study setting and population characteristics. These differences highlight the necessity of area-specific data to improve the knowledge of clinical and etiological pictures of atypical febrile seizures.

## Conclusion

The current observational study of children between the ages of 6 months and 5 years with atypical febrile seizures in hospitals shows that there is a definite male dominance of cases, with majority being witnessed in children above the age of one year. Recurrence of seizures in 24 hours was the most common type of unusual presentation and the other unusual features including prolonged duration and focality as well as other neurological abnormalities were lower. Some of the children exhibited other issues such as developmental delay, signs of meningitis, and microcephaly implying that close neurological examinations were required. Key risk factors identified for recurrence included early age at onset, shorter duration of fever prior to seizure, moderate-grade fever, family history, male gender, and electrolyte imbalance. Notably, meningitis was identified in a considerable proportion of cases, underscoring the importance of evaluating underlying central nervous system infections in children presenting with atypical febrile seizures. Overall, the findings highlight the diverse clinical profile and multifactorial etiology of atypical febrile seizures, emphasizing the need for thorough evaluation and close monitoring to guide management and prevent recurrence.

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