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Original Article

Risk Factors for Seizure Recurrence in Children with Febrile Seizures

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Abstract

Background: Febrile seizures happen in children between 6 months and 5 years with fever, impacting 2%–5%, and about one-third recur, typically within 1–2 years. They are categorized as either simple or complex. Recurrence is associated with factors like early onset age, family background, reduced fever intensity, and brief fever duration. This study seeks to pinpoint significant risk factors for recurrence to enhance management and guidance.

Methods: This observational study conducted in a hospital involved 35 children between 6 months and 5 years who were clinically diagnosed with febrile seizures inthe department of Emergency, Observation & Referral, Bangladesh Shishu Hospital & Institute. Clinical, demographic, and laboratory data were analysed using SPSS v25.0 to determine predictors of recurrence, with ethical approval and informed consent secured.

Results: Out of 35 children experiencing febrile seizures, 34.3% experienced a recurrence. Younger age (<2 years), a family history, brief fever duration (<24 hours), and multiple seizures occurring within 24 hours were significant predictors ($p<0.05$). Logistic regression indicated higher odds of recurrence for age under 2 years (OR=2.8), a family history (OR=3.5), fever lasting less than 24 hours (OR=2.9), and multiple seizures (OR=3.8), with hyponatremia demonstrating borderline significance.

Conclusion: Recurrent febrile seizures were common and associated with younger age, a family history, brief fever duration, and several seizures occurring within a 24-hour period. There was also a connection to extended seizures and low sodium levels. These elements assist in evaluating risks and providing guidance, with additional extensive studies required for validation.

Keywords: Febrile Seizures, Recurrence, Risk Factors, Children

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Introduction

A febrile seizure is a convulsion in a child between 6 months and 5 years old that happens with a fever of ≥ 100.4°F (38°C), without signs of central nervous system infection or any other clear reason [1]. They happen in

approximately 2%–5% of children, and around one-third of those affected have a relapse [2]. Recurrences are frequent and usually occur shortly after the initial episode, with the majority happening in the first one to two years [3].

Febrile seizures are categorized into simple or complex types. Simple seizures are generalized, last for less than 15 minutes, and happen once every 24 hours, while complex seizures are extended, focal, or happen again within 24 hours [4]. The incidence and recurrence of febrile seizures vary across ethnic and geographic populations, suggesting the influence of genetic and environmental factors [5,6].

Several predictors of recurrence have been identified in previous studies. Younger age at first seizure, family history of febrile seizures or epilepsy, lower peak fever, and shorter duration of fever before seizure onset have consistently been associated with increased recurrence risk [1,7–9]. In addition, prolonged seizure duration and multiple seizures during the same febrile episode have been reported as important clinical predictors [6]. Some studies have also suggested associations with male sex, recurrent febrile illnesses, electrolyte imbalance, and iron deficiency anemia [10-12].

A study from Bangladesh reported that younger age, abnormal electroencephalographic or neuroimaging findings, and positive family history were significant predictors of seizure recurrence in children [11]. Despite extensive research, the recurrence of febrile seizures remains difficult to predict because of variations in study populations and associated risk factors. Identification of recurrence predictors is important for appropriate counseling of caregivers, risk stratification, and long-term management of affected children. The aim of the study was to determine and assess the risk factors linked to the reoccurrence of febrile seizures in children.

MATERIALS AND METHODS:

Study Design and Setting:

This hospital-based observational study was conducted in the department of Emergency, Observation & Referral(EOR) at Bangladesh Shishu Hospital & Institute over a period of 12 months from July 2024 to June 2025.

Study Population:

Among children aged 0–14 years presenting with clinically diagnosed seizures during the study period, children aged 6 months to 5 years who fulfilled the diagnostic criteria for febrile seizures were included in the present analysis. Febrile seizure was defined as a seizure occurring in association with fever (body temperature ≥38°C) in the absence of central nervous system infection, metabolic abnormalities, or previous afebrile seizures.

Inclusion Criteria:

Children fulfilling the following criteria were included in the study:

- Age between 6 months and 5 years
- Clinically diagnosed febrile seizure
- Availability of relevant clinical and laboratory information
- Parents or guardians willing to provide informed consent

Exclusion Criteria

Children were excluded if they had:

- Evidence of meningitis, encephalitis, or other central nervous system infections
- History of epilepsy or afebrile seizures
- Congenital neurological disorders or developmental abnormalities
- Seizures secondary to identifiable metabolic causes
- Incomplete medical records

Sample Size and Sampling Technique

A total of 35 children with febrile seizures were included in this study using purposive sampling according to the eligibility criteria.

Data Collection Procedure

Data were collected using a predesigned semi-structured case record form. Information regarding demographic profile, clinical presentation, seizure characteristics, family history, perinatal history, and laboratory findings was obtained from caregivers and hospital records.

Variables collected included age, sex, duration of fever before seizure onset, peak body temperature, seizure type, seizure duration, recurrence within 24 hours, associated clinical symptoms, and family history of seizures. Perinatal factors such as prematurity, low birth weight, and history of neonatal seizures were also documented. Relevant laboratory findings including serum sodium level and hemoglobin concentration were recorded where available.

Participants were categorized into two groups:

- Recurrent febrile seizure group
- Non-recurrent febrile seizure group

Recurrence was defined as the occurrence of more than one febrile seizure episode either during the same febrile illness or during subsequent febrile episodes.

Statistical Analysis

Data were entered and analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. Comparisons between recurrent and non-recurrent groups were performed using Student's t-test for continuous variables and Chi-square test or Fisher's exact test for categorical variables, as appropriate. Multivariate logistic regression analysis was performed to identify independent predictors of recurrence. Adjusted odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. A p-value of <0.05 was considered statistically significant.

Ethical Consideration

Ethical approval was obtained from the institutional ethical review committee of Bangladesh Shishu Hospital & Institute. Written informed consent was obtained from the parents or legal guardians of all participants prior to enrollment. Confidentiality and anonymity of the study participants were strictly maintained throughout the study period.

RESULTS:

Study Population and Frequency of Febrile Seizures

A total of 127 pediatric patients with seizure episodes were initially evaluated. Among them, 55 children (43.3%) were identified as having febrile seizures, while the remaining were excluded due to alternative etiologies such as afebrile seizures, CNS infections, and metabolic causes. Of the 55 febrile seizure cases, 35 children met the inclusion criteria and were included in the final analysis.Among these 35 children, 12 (34.3%) experienced recurrent febrile seizures, whereas 23 (65.7%) had a single episode only.

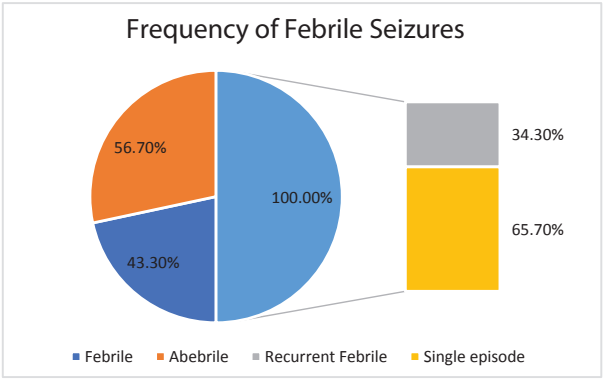

Figure I: Distribution of seizure types among the total study population (n = 127)

Figure Idemonstrates a hierarchical distribution: from the total seizure population, a significant febrile seizure subset is identified, and within this subset, recurrence is a common clinical pattern.

Demographic and Clinical Characteristics

Table 1 compares the demographic and baseline clinical characteristics between children with recurrent and non-recurrent febrile seizures. Children with recurrent febrile seizures were significantly younger than those without recurrence (2.6 ± 1.4 years vs. 3.7 ± 2.0 years, p=0.04). A significantly higher proportion of recurrent cases were aged below 2 years compared to the non-recurrent group (58.3% vs. 26.1%, p=0.05). Family history of seizures was also significantly more common among children with recurrent febrile seizures (50.0% vs. 17.4%, p=0.04). Although sibling history of seizures was more frequent in the recurrent group (25.0% vs. 4.3%), the difference did not reach statistical significance (p=0.09). No significant difference was observed regarding sex distribution between the two groups (p=0.88).

Table 1: Comparison of Demographic and Clinical Characteristics Between Recurrent and Non-Recurrent Febrile Seizures (n = 35)

Variable	Recurrent (n = 12), n (%)	Non-Recurrent (n = 23), n (%)	p-value
Age (years), mean ± SD	2.6 ± 1.4	3.7 ± 2.0	0.04*
Age <2 years	7 (58.3)	6 (26.1)	0.05*
Sex (Male)	7 (58.3)	14 (60.9)	0.88
Family history of seizure	6 (50.0)	4 (17.4)	0.04*
Sibling affected	3 (25.0)	1 (4.3)	0.09

Clinical Features Associated with Recurrence

Table 2 shows fever duration of less than 24 hours before the seizure episode was significantly more common among recurrent cases compared to non-recurrent cases (66.7% vs. 30.4%, p=0.04). Similarly, a peak body temperature below 39°C was significantly associated with recurrence (58.3% vs. 26.1%, p=0.05). Other clinical symptoms, including vomiting, lethargy, and impaired consciousness, were more frequent among recurrent cases but did not show statistically significant associations with recurrence (p>0.05).

Table 2: Clinical Features Associated with Recurrence (n = 35)

Clinical Feature	Recurrent (n = 12), n (%)	Non-Recurrent (n = 23), n (%)	p-value
Fever duration <24 hours before seizure	8 (66.7)	7 (30.4)	0.04*
Peak temperature <39°C	7 (58.3)	6 (26.1)	0.05*
Vomiting	5 (41.7)	6 (26.1)	0.34
Lethargy	4 (33.3)	5 (21.7)	0.47
Impaired consciousness	4 (33.3)	6 (26.1)	0.66

Seizure Characteristics and Recurrence

Table 3 demonstrates the relationship between seizure characteristics and recurrence. Most seizures were generalized in both recurrent and non-recurrent groups (75.0% vs. 82.6%, respectively), with no statistically significant difference in seizure type (p=0.58). However, prolonged seizure duration (≥15 minutes) was significantly associated with recurrence, occurring in 41.7% of

recurrent cases compared to 13.0% of non-recurrent cases (p=0.05). In addition, multiple seizure episodes within 24 hours were significantly more frequent among recurrent cases (50.0% vs. 17.4%, p=0.04).

Table 3: Seizure Characteristics and Recurrence (n = 35)

Variable	Recurrent (n = 12), n (%)	Non-Recurrent (n = 23), n (%)	p-value
Seizure type			0.58
Generalized	9 (75.0)	19 (82.6)	
Focal/Complex	3 (25.0)	4 (17.4)	
Duration ≥15 minutes	5 (41.7)	3 (13.0)	0.05*
Multiple seizures within 24 hrs	6 (50.0)	4 (17.4)	0.04*

Perinatal and Laboratory Factors

Table 4 presents preterm birth, low birth weight, and history of neonatal seizures were more commonly observed among recurrent cases; however, these associations did not achieve statistical significance (p>0.05). Hyponatremia was identified in 41.7% of recurrent cases compared to 13.0% of non-recurrent cases and demonstrated a borderline significant association with recurrence (p=0.05). Although anemia was more prevalent in the recurrent group (50.0% vs. 30.4%), the association was not statistically significant (p=0.26).

Table 4: Perinatal and Laboratory Factors Associated with Recurrence (n = 35)

Variable	Recurrent (n = 12), n (%)	Non-Recurrent (n = 23), n (%)	p-value
Preterm birth	3 (25.0)	1 (4.3)	0.08
Low birth weight	4 (33.3)	2 (8.7)	0.06
Neonatal seizure history	3 (25.0)	1 (4.3)	0.08
Hyponatremia	5 (41.7)	3 (13.0)	0.05*
Anemia	6 (50.0)	7 (30.4)	0.26

Multivariate Logistic Regression Analysis

Table 5 identified several independent predictors of recurrent febrile seizures. Children younger than 2 years had approximately 2.8 times higher odds of recurrence compared to older children (Adjusted OR=2.8, 95% CI: 1.1–7.5, p=0.04). A positive family history of seizures was also independently associated with recurrence (Adjusted OR=3.5, 95% CI: 1.2–9.8, p=0.03). Fever duration of less than 24 hours before seizure onset increased the likelihood of recurrence by nearly threefold (Adjusted OR=2.9, 95% CI: 1.1–8.2, p=0.04). Furthermore, children who experienced multiple seizures within 24 hours had significantly increased odds of recurrence (Adjusted OR=3.8, 95% CI: 1.3–10.5, p=0.02). Hyponatremia showed an increased odds ratio for recurrence (Adjusted OR=2.6, 95% CI: 1.0–7.1), although the association was borderline significant (p=0.06).

Table 5: Multivariate Logistic Regression Analysis of Factors Associated with Recurrence

Variable	Adjusted OR	95% CI	p-value
Age <2 years	2.8	1.1 – 7.5	0.04*
Family history of seizure	3.5	1.2 – 9.8	0.03*
Fever duration <24 hrs	2.9	1.1 – 8.2	0.04*
Multiple seizures in 24 hrs	3.8	1.3 – 10.5	0.02*
Hyponatremia	2.6	1.0 – 7.1	0.06

DISCUSSION:

This study identified younger age, early onset, and a positive family history as predictors of recurrent febrile seizures, showing no difference based on sex. Kantamalee et al. (2017) also recognized younger age, brief fever duration, and family history as significant risk factors, highlighting early-life recurrence. Both studies emphasize the influence of clinical and family factors on the risk of recurrence[13].

The current study found that a shorter fever duration and a lower peak temperature were notably linked to recurrent febrile seizures, whereas other symptoms did not show significance. Likewise, Kim et al. (2024) found that the early onset of seizures during fever is a crucial predictor of recurrence, while related clinical symptoms offer limited predictive significance. Both studies emphasize fever characteristics as crucial risk factors for recurrence[14].

The current study indicated that seizure type did not correlate with recurrence, whereas prolonged seizures and several episodes within 24 hours were important predictors. Mizorogi et al. (2015) also indicated that extended seizure duration and clustered seizures heighten the risk of recurrence. Both studies suggest that the severity of seizures, not their type, is a crucial element in forecasting recurrence[15].

The current study demonstrated no notable relationship between perinatal factors and recurrence, while hyponatremia exhibited a marginal connection and anemia proved to be insignificant. In the same vein, Castellazzi et al. (2024) indicated that electrolyte imbalances, particularly hyponatremia, are more significant for early recurrence compared to perinatal factors. Both studies emphasize the significance of metabolic factors in evaluating recurrence risk[16].In this study identified that age under 2 years, a positive family history, brief fever duration, and

several seizures in 24 hours are standalone predictors of recurrence, whereas hyponatremia displayed a marginal correlation. In general, recurrence is primarily associated with younger age, genetic factors, severity of seizures, and metabolic conditions. These results align with earlier research [13-16].In summary, recurrent febrile seizures are primarily linked to younger age, a positive family history, factors related to fever, the severity of seizures, and metabolic imbalances, highlighting the necessity of prompt recognition and suitable monitoring of children at high risk.

CONCLUSION:

Recurrent febrile seizures were observed in a considerable proportion of children with febrile seizures in this study. Younger age at onset, positive family history of seizures, shorter duration of fever before seizure onset, and multiple seizures within 24 hours were identified as significant predictors of recurrence. Prolonged seizure duration and hyponatremia also showed important associations with recurrent episodes. Early identification of these risk factors may help clinicians in risk stratification, parental counseling, and appropriate follow-up planning for children with febrile seizures. Further large-scale multicenter studies are recommended to better understand recurrence patterns and develop predictive models for clinical practice.

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