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ORIGINAL ARTICLE

ETIOLOGICAL CLINICAL AND LABORATORY PROFILE OF CHILDREN ADMITTED WITH FEBRILE SEIZURES IN A TERTIARY CARE HOSPITAL OF WESTERN NEPAL

Laxman Paudel[1]*, Arun Pokhrel[2], Sumina Shrestha[1], Dipim Gautam [3]

[1]Department of Paediatrics, Devdaha Medical College, Rupendehi, Nepal

[2]Arun Pokhrel, Siddhartha Children and Women Hospital, Rupendehi, Nepal

[3]Department of Clinical Science, Intern, Devdaha Medical College, Rupendehi, Nepal

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Correspondence to:

Laxman Paudel,

Devdaha Medical College & Research Institute, Rupendehi, Nepal

E-mail:laxmanpaudel8@gmail.com

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ABSTRACT

Introduction: *Febrile seizures are the most common seizure disorder in childhood and are a frequent cause of hospital admission. Information regarding the demographic, clinical, etiological, and laboratory characteristics of febrile seizures in Nepal remains limited. This study aimed to evaluate the demographic, etiological, clinical, and laboratory profile of children admitted with febrile seizures in a tertiary care hospital in Western Nepal.*

Materials and Methods: *A hospital-based prospective observational study was conducted at Siddhartha Children and Women Hospital, Butwal, from September 2023 to September 2025. Children aged 6–60 months admitted with febrile seizures were enrolled consecutively. Demographic characteristics, clinical features, etiological diagnosis, and laboratory parameters were recorded. Febrile seizures were classified as simple or complex according to standard criteria. Data were analysed using SPSS version 26. Descriptive statistics were used to summarize the data, and the Chi-square test was applied to assess associations between variables. A p-value <0.05 was considered statistically significant.*

Results: *A total of 77 children were included in the study. Boys comprised 55.8% of participants, and the mean age was 26.7 ± 12.2 months. Generalized tonic-clonic seizures were the most common seizure type (80.5%). Simple febrile seizures accounted for 66.2% of cases, whereas 33.8% were classified as complex febrile seizures. Acute respiratory infection was the most common etiology (57.1%), followed by fever without source (18.2%), urinary tract infection (13.0%), and dengue fever (11.7%). A previous history of febrile seizures was present in 31.2% of children, and 27.3% had a positive family history. Anemia, leukocytosis, and hyponatremia were observed in 93.5%, 62.3%, and 24.7% of participants, respectively. Etiology (p=0.0012) and family history of febrile seizures (p=0.036) showed significant associations with seizure classification, whereas age, sex, anemia, leukocytosis, hyponatremia, and fever at presentation did not.*

Conclusion: *Febrile seizures predominantly affected children aged 13–36 months and were more common in boys. Generalized tonic-clonic seizures and acute respiratory infections were the predominant clinical and etiological findings. Significant associations were observed between seizure classification, etiology, and family history. Larger multicenter studies with long-term follow-up are needed to further evaluate factors associated with seizure characteristics and outcomes.*

Keywords: *Acute Respiratory Infection, Child, Family History, Febrile Seizures, Nepal,Recurrence*

INTRODUCTION

Febrile seizures are the most common seizure disorder in childhood and represent a frequent neurological emergency encountered in pediatric practice. They are defined as seizures occurring in association with fever in children aged between 6 and 60 months, without evidence of central nervous system infection, metabolic disturbances, or a previous afebrile seizure disorder[1]. Although generally benign and self-limiting, febrile seizures are a major source of anxiety for parents and often lead to emergency department visits and hospital

admissions.

The reported prevalence of febrile seizures varies across different populations and geographic regions. Approximately 2–5% of children in North America and Europe experience at least one febrile seizure during childhood, whereas higher prevalence rates have been reported in Asian countries, ranging from 5% to 10%[2]. One study done in Western Nepal had reported the prevalence of febrile seizure around 2.48%[3].Febrile seizures occur most commonly between 6 months and 5 years of age, with peak incidence during the second and third years of life[4]. Males are affected slightly more frequently than females[4].

The exact pathogenesis of febrile seizures remains incompletely understood. Current evidence suggests that the interaction between genetic susceptibility and environmental factors plays an important role in their development[5]. Several studies have identified factors associated with febrile seizures, including younger age, male sex, and positive family history of febrile seizures, prenatal and perinatal complications, micronutrient deficiencies, electrolyte imbalances, and infectious illnesses. Acute respiratory infections, viral illnesses, urinary tract infections, and other febrile conditions are among the most common triggers[6].

Despite the high burden of febrile seizures, data from Nepal remain limited, particularly regarding their demographic characteristics, etiological spectrum, clinical presentation, and associated laboratory findings. Therefore, this study was conducted to evaluate the demographic, etiological, clinical, and laboratory profile of children aged 6–60 months admitted with febrile seizures to a tertiary care hospital in Western Nepal and to assess the association of selected clinical and laboratory parameters with seizure classification.

MATERIALS AND METHODS

This hospital-based prospective observational study was conducted in the Department of Pediatrics at Siddhartha Children and Women Hospital, Butwal, Nepal, from September 2023 to September 2025. Ethical approval was obtained in Nepali calender year 2078/2079(Reference No. 768/078/079) corresponding to 2022 AD. Written informed consent was obtained from parents or legal guardians of all enrolled children.

All children aged 6–60 months admitted with febrile seizures during the study period were eligible for inclusion. Febrile seizure was defined as a seizure occurring in association with fever (body temperature ≥38°C or documented history of fever within the preceding 24 hours) in the absence of central nervous system infection, metabolic abnormalities, or a prior afebrile seizure disorder.

Children younger than 6 months or older than 60 months, those with afebrile seizures, developmental delay, known epilepsy, central nervous system infections, or inborn errors of metabolism were excluded from the study.

Consecutive sampling was employed, and all eligible children admitted during the study period were included. Based on a reported prevalence of febrile seizures of 2.48%[3], the minimum sample size calculated using the formula $n=z^2 \times p\ (1-p)/d^2$ at a 95% confidence level and 5% margin of error was 38 participants. The final study population comprised 77 children, which exceeded the minimum required sample size.

Febrile seizures were classified according to the criteria described by Nelson and Ellenberg[7]. Simple febrile seizures were defined as generalized seizures lasting less than 15 minutes and not recurring within 24 hours. Complex febrile seizures were defined as seizures with focal features, duration greater than 15 minutes, or recurrence within 24 hours[8].

Seizure semiology was separately categorized as generalized tonic-clonic seizure (GTCS) or focal seizure based on clinical presentation.

Anemia was defined as hemoglobin concentration <11 g/dL in children aged 6–60 months according to World Health Organization criteria[9]. Leukocytosis was defined as a total leukocyte count >11,000 cells/mm. Hyponatremia was defined as serum sodium concentration <135 mmol/L[10].

The underlying cause of fever was determined based on

clinical evaluation and relevant laboratory investigations. Acute respiratory infection (ARI) was diagnosed in children presenting with fever and respiratory symptoms such as cough, rhinorrhea, sore throat, or respiratory distress, supported by clinical examination findings.Urinary tract infection (UTI) was diagnosed based on compatible clinical features and urine microscopy and/or urine culture findings.Dengue fever was diagnosed by positive NS1 antigen or dengue IgM serology.Fever without source was defined as fever without an identifiable focus after clinical examination and routine investigations.

Data were collected using a structured proforma. Information regarding age, sex, residence, seizure characteristics (type, duration, frequency, and previous history), family history of febrile seizures, clinical diagnosis, and laboratory parameters was recorded. Laboratory investigations included hemoglobin concentration, total leukocyte count, serum sodium, and serum potassium levels obtained during hospital admission.Data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 26. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were presented as frequency and percentage. The Chi-square test was used to assess associations between categorical variables and seizure classification (simple versus complex febrile seizure). Independent-samples t-test was used to compare mean laboratory parameters between groups. A p-value <0.05 was considered statistically significant.

RESULTS

During the study period, 3,789 children were admitted to the hospital, of whom 77 children aged 6–60 months fulfilled the eligibility criteria and were enrolled in the study.

Demographic Characteristics

Among the 77 children with febrile seizures, 43 (55.8%) were boys and 34 (44.2%) were girls, giving a male-to-female ratio of 1.26:1. The mean age of the participants was 26.7 ± 12.2 months. The highest proportion of cases occurred in the 13–36 months age group, followed by 6–12 months, whereas the fewest cases were observed among children aged 49–60 months.

Clinical Characteristics

Generalized tonic-clonic seizures (GTCS) were the most common seizure type and were observed in 62 (80.5%) children, while focal seizures were present in 15 (19.5%) children.

The duration of seizure was less than one minute in 41 (53.2%) children, between one and two minutes in 22 (28.6%), and greater than two minutes in 14 (18.2%) children.

Based on standard classification criteria, 51 (66.2%) children had simple febrile seizures and 26 (33.8%) had complex febrile seizures.

A single seizure episode within 24 hours occurred in 52 (67.5%) children, whereas 25 (32.5%) experienced multiple seizure episodes. A previous history of febrile seizures was present in 24 (31.2%) children, and a positive family history of febrile seizures was noted in 21 (27.3%) children.

Fever at admission was documented in 36 (46.8%) children, with a mean recorded temperature of 100.3 ± 0.22°F. The remaining children had a documented history of fever before the onset of seizure.

Etiology of Fever

Acute respiratory infection was the most common identified cause of fever, accounting for 44 (57.1%) cases. Other etiologies included fever without source in 14 (18.2%) children, urinary tract infection in 10 (13.0%), and dengue fever in 9 (11.7%) children.

Laboratory Findings

The mean hemoglobin level was 9.7 ± 1.1 g/dL. Anemia (hemoglobin <11 g/dL) was present in 72 (93.5%) children.

The mean total leukocyte count was 12,980 ± 3,420 cells/mm³. Leukocytosis (total leukocyte count >11,000 cells/mm³) was observed in 48 (62.3%) children.

Hyponatremia was present in 19 (24.7%) children.

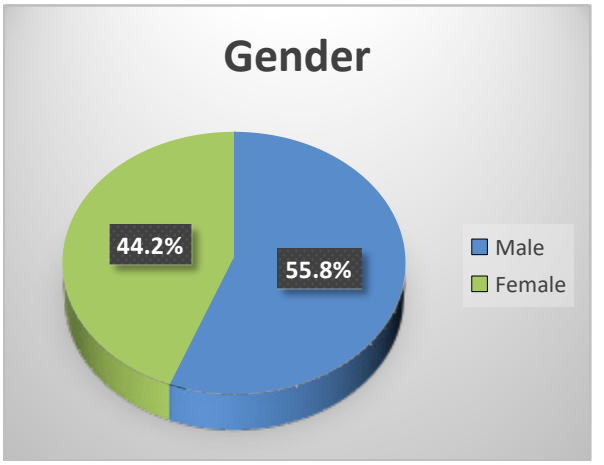

Figure 1: Demographic characteristics of children with febrile seizure n=77

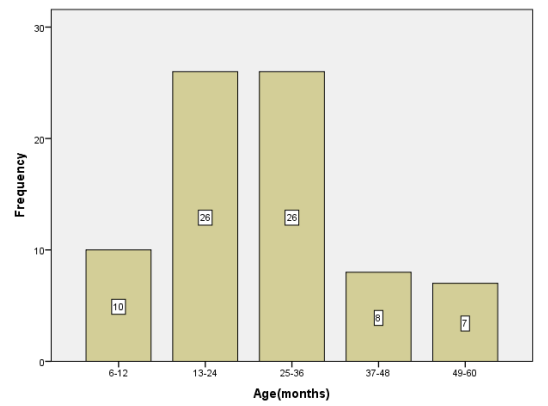

Figure 2: Bar diagram showing the age group of patients

Table 1: Clinical characteristics of febrile seizure

Variable	Frequency (n)	Percentage (%)
Type of Seizure		
GTCS	62	80.5
Focal	15	19.5
Recurrence within 24 hours		
Single episode	52	67.5
Multiple episode	25	32.5
Past history of febrile seizure		
Present	24	31.2
Absent	53	68.8

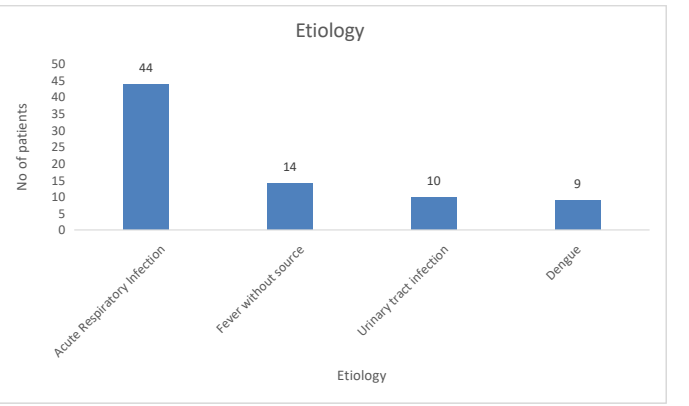

Figure 3: Bar diagram showing frequency of etiology

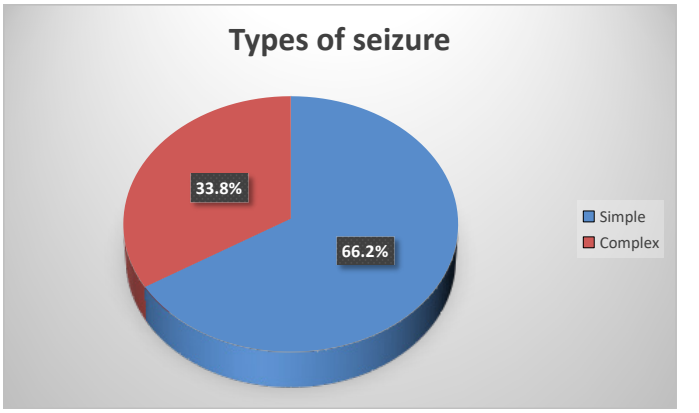

Figure 4: Pie chart showing the type of seizure

Table 2: Association of study variables with simple and complex febrile seizure

Variables	Category	Type of Seizure		P value
		Simple	Complex	
Sex	Female	24(70.6)	10(29.4)	0.634
	Male	27(62.8)	16(37.2)	
Age group(months)	6-12	7(70)	3(30)	0.14
	13-24	19(73.1)	7(26.9)	
	25-36	16(61.5)	10(38.5)	
	37-48	7(87.5)	1(12.5)	
	49-60	2(28.6)	5(71.4)	
Recurrence within 24 hours	Single	38(67.9)	18(32.1)	0.718
	Multiple	12(60)	8(40)	
Etiology	ARI	22(50)	22(50)	0.0012
	Others	29(87.9)	4(12.1)	
Family History	No	32(58.2)	23(41.8)	0.036
	Yes	19(86.4)	3(13.6)	
Fever	Absent	28(68.3)	13(31.7)	0.868
	Present	23(63.9)	13(36.1)	
Anemia	Absent	3(60)	2(40)	0.987
	Present	48(66.7)	24(33.3)	

Leukocytosis	Absent	32(76.2)	10(23.8)	0.075
	Present	19(54.3)	16(45.7)	
Hyponatremia	Absent	35(71.4)	14(28.6)	0.306
	Present	16(57.1)	12(42.9)	

Chi-square test was used to compare categorical variables between simple and complex febrile seizures

A statistically significant association was observed between etiology and seizure type (p=0.0012). Complex febrile seizures were more frequent among children with acute respiratory infection (50.0%) compared with those with other causes of fever (12.1%).

Family history of febrile seizures was also significantly associated with seizure type (p=0.036). Complex febrile seizures occurred in 13.6% of children with a positive family history compared with 41.8% of those without a family history.

No statistically significant associations were found between seizure type and sex (p=0.634), age group (p=0.140), seizure recurrence within 24 hours (p=0.718), fever at presentation (p=0.868), anemia (p=0.987), leukocytosis (p=0.075), or hyponatremia (p=0.306).

Table 3: Mean difference in laboratory parameters between simple and complex febrile seizure

Lab parameters	Simple	Complex	P value
Hb	9.91±0.62	9.98±0.77	0.678
TC	11919.60±3837.51	10884.62±3825.52	0.266
Na	136.53±2.57	135.67±2.98	0.188
k	3.98±0.37	4.10±0.37	0.136

Independent samples t-test was used to compare mean laboratory parameters between groups.

Comparison of mean laboratory parameters between simple and complex febrile seizures using the independent-samples t-test showed no significant differences in hemoglobin level (p=0.678), total leukocyte count (p=0.266), serum sodium level (p=0.188), or serum potassium level (p=0.136).

DISCUSSION

Febrile seizures are among the most common neurological disorders encountered during early childhood and represent a frequent cause of pediatric hospital admission. Although primarily benign, childhood febrile seizures can be frightening and anxiety-provoking events for parents and caregivers[1]. Recent international guidelines continue to emphasize that simple febrile seizures are generally benign and do not require extensive neurodiagnostic evaluation in neurologically normal children[10].This study evaluated the demographic, clinical, etiological, and laboratory characteristics of children admitted with febrile seizures to a tertiary care hospital in Western Nepal.

In our study, males constituted 55.8% of cases, with a male-to-female ratio of 1.26:1. Similar male predominance has been reported in various studies. Pokhrel et al reported that 59.7% of children with febrile seizures were male[11], while Shrestha et al. also observed a higher frequency among boys[12] . The reason for this sex difference remains uncertain but may be related to genetic susceptibility and sex-related differences in neurodevelopment and seizure threshold.

The mean age of the participants was 26.7 ± 12.2 months, and the majority of children belonged to the 13–36 months age group. Similar age distributions have been reported by Pokhrel et al. and Shankar P et al[11,13]. Increased neuronal excitability and developmental immaturity of the central nervous system during early childhood may contribute to the increased susceptibility to febrile seizures in this age group.

Generalized tonic-clonic seizures were the most common seizure semiology, accounting for 80.5% of cases, whereas focal seizures comprised 19.5%. Most children were also classified as having simple febrile seizures (66.2%), while one-third had complex febrile seizures. These findings are comparable to previous studies from Nepal and neighboring countries where generalized seizures and simple febrile seizures constitute the predominant clinical presentation[11,13,14,15].

The present study evaluated the association between demographic, clinical, and laboratory variables and seizure classification (simple versus complex febrile seizure). Among the variables examined, etiology and family history demonstrated statistically significant associations with seizure classification.

Acute respiratory infection (ARI) was significantly associated with seizure type, with a greater proportion of children with ARI presenting with complex febrile seizures compared with children having other causes of fever. Respiratory tract infections are among the most common triggers of febrile seizures worldwide and have consistently been identified as the leading infectious cause in many hospital-based studies[11,14,15]. The higher proportion of complex seizures among children with ARI in our study may be related to the intensity of the inflammatory response and rapid fluctuations in body temperature associated with respiratory infections. However, because this was an observational study, causality cannot be established and the finding should be interpreted as an association rather than a predictive factor.

A significant association was also observed between family history and seizure classification.Children with positive family history were more likely to present with simple febrile seizures than complex febrile seizures. Although family history is recognized risk factors for febrile seizure occurence, its relationship with seizure complexity remains inconsistent across studies. A systematic review and meta-analysis by Veisani et al. reported that approximately 28.8% of children with febrile seizures had a positive family history[16], highlighting the importance of genetic factors in the development of febrile seizures. Our finding of a positive family history in 27.3% of children is remarkably similar to that analysis and further supports the role of inherited susceptibility in febrile seizures.

No significant associations were found between seizure classification and sex, age group, fever at presentation, anemia, leukocytosis, hyponatremia, or seizure recurrence within 24 hours. Although several studies have suggested that younger age, lower serum sodium levels, and certain hematological abnormalities may be associated with more severe seizure manifestations, our findings did not demonstrate statistically significant relationships. The relatively small sample size and single-center design may have limited the ability to detect weaker associations.

The mean hemoglobin concentration in our study population was below the normal range for age, and 93.5% of children were found to be anemic. Study done by Shankar P et al had shown 71.66% were anemic in their studies[13]. This prevalence is considerably higher than that reported in many international studies and may reflect the high burden of nutritional anemia among Nepalese children specially in our areas. Although anemia was highly prevalent, no significant difference in hemoglobin levels was observed between children with simple and complex febrile seizures.

The relationship between anemia and febrile seizures remains controversial. A recent systematic review and meta-analysis by Sulviani et al., which included 20 studies and more than 3,800 participants, demonstrated that iron deficiency anemia and poor iron indices were significantly associated with an increased risk of febrile seizures[17]. Similarly, Habibian et al. reported a positive association between iron deficiency anemia and febrile seizures in their meta-analysis[18]. These findings suggest that iron deficiency may lower the seizure threshold through alterations in neurotransmitter metabolism, myelination, and cerebral oxygen delivery. However, our study evaluated differences between simple and complex febrile seizures rather than comparing febrile seizure cases with healthy controls; therefore, the absence of a significant association with seizure classification does not exclude a possible role of anemia in febrile seizure susceptibility.

Leukocytosis was observed in 62.3% of children, reflecting the infectious etiology underlying the febrile illness. The mean total leukocyte count did not differ significantly between simple and complex febrile seizures. This finding suggests that leukocytosis is more likely to represent the host inflammatory response to infection rather than a determinant of seizure severity. Similar observations have been reported in several pediatric studies where elevated leukocyte counts were associated with underlying infection but not with seizure characteristics.

Hyponatremia was present in approximately one-quarter of the study population. Although serum sodium levels were slightly lower among children with complex febrile seizures, the difference was not statistically significant. This finding differs from the results of a recent meta-

analysis by Miyagi et al., which demonstrated significantly lower serum sodium concentrations among children who experienced recurrent febrile seizures during the same febrile illness[19]. The authors reported that hyponatremia was associated with seizure recurrence and identified a serum sodium level of approximately 134.7 mmol/L as a potential threshold for increased risk. However, evidence regarding the clinical utility of serum sodium as a predictor of seizure severity or recurrence remains inconsistent across studies. Our results suggest that routine serum sodium measurement may have limited value in distinguishing simple from complex febrile seizures in otherwise stable children.

Similarly, no significant differences were observed in serum potassium levels between simple and complex febrile seizures. Electrolyte disturbances have been proposed to influence neuronal excitability; however, the current findings do not support a major role for serum potassium in determining seizure classification among children with febrile seizures.

Overall, the laboratory findings indicate that anaemia, leucocytosis, and electrolyte abnormalities are common among children with febrile seizures, but these parameters were not significantly associated with seizure classification in our study. Larger multicentre studies incorporating iron studies, inflammatory biomarkers, and detailed electrolyte assessment are needed to further clarify their role in the pathophysiology and clinical spectrum of febrile seizures.

The study has several limitations. First, it was a single-center hospital-based study and may not be representative of all children with febrile seizures in the community. Second, the sample size was relatively small, limiting the power to detect weaker associations. Third, only hospitalized patients were included, introducing the possibility of selection bias toward more severe cases. Fourth, a control group was not available for comparison of laboratory parameters. Fifth, iron studies and other micronutrient assessments were not performed. Finally, long-term follow-up was not conducted; therefore, recurrence rates and subsequent development of epilepsy could not be evaluated.

Despite these limitations, this study provides important regional data regarding the demographic, clinical, etiological, and laboratory characteristics of children with febrile seizures in Western Nepal. Larger multicenter studies with long-term follow-up are warranted to further clarify factors associated with seizure characteristics and recurrence.

CONCLUSION

Febrile seizures in our study predominantly affected children aged 13–36 months and were more common in boys. Generalized tonic-clonic seizures were the most frequent clinical presentation, while acute respiratory infections constituted the leading underlying febrile illness. Anemia, leukocytosis, and hyponatremia were commonly observed laboratory abnormalities among affected children.

A significant association was observed between seizure classification and both etiology and family history of febrile seizures. However, no significant associations were found between seizure classification and sex, age, anemia, leukocytosis, hyponatremia, or fever at presentation.

These findings suggest that febrile seizures in our setting are primarily associated with common childhood infections and occur predominantly during early childhood. Recognition of the underlying infectious etiology and careful assessment of family history may aid in the clinical evaluation of children presenting with febrile seizures. Further large-scale multicenter studies with long-term follow-up are needed to better understand factors associated with seizure characteristics, recurrence, and long-term neurological outcomes.

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