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CLINICAL OUTCOMES OF FEBRILE SEIZURES IN CHILDREN UNDER FIVE YEARS OF AGE

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Abstract
Background: Febrile seizures (FS) are the most common seizure disorder in children under five years, often triggered by fever without intracranial infection. Although generally benign, they can cause significant parental anxiety and, in some cases, lead to recurrence or later epilepsy, warranting evaluation of clinical outcomes and risk factors.
Objectives: To assess the clinical outcomes, recurrence rates, and predictors of adverse neurological events among children under five years presenting with febrile seizures.
Study design: A cross-sectional Study.
Place and duration of the study: Department of Pediatrics Lady Reading Hospital Peshawar, Pakistan from Jan 2023 to jan 2024.
Methodology: 100 children aged 6 months to 5 years presenting with FS. Data regarding seizure type, duration, family history, and recurrence were collected. Statistical analysis was performed using SPSS version 24.0, with $p < 0.05$ considered significant.
Results: The study included 100 patients with a mean age of 30.4 ± 12.6 months. Simple febrile seizures were observed in 72%, while complex febrile seizures occurred in 28%. A family history of seizures was present in 22% of cases. Recurrence occurred in 18% of patients, and 2% developed epilepsy. A statistically significant association was found between complex seizures and recurrence ($p = 0.032$).
Conclusion: Most children with febrile seizures have favorable outcomes with minimal risk of long-term neurological complications. However, complex FS and a positive family history significantly increase recurrence risk, highlighting the importance of parental education, early identification, and regular follow-up for better clinical management.

Keywords: Febrile seizures, epilepsy, recurrence, pediatrics

Introduction

Febrile seizures (FS) are the most common type of convulsion in children, affecting approximately 2–5% of those under five years of age worldwide [1]. The condition is defined as a seizure occurring in association with fever (temperature ≥38°C) in the absence of central nervous system infection, metabolic imbalance, or prior afebrile seizures [2]. Febrile seizures typically occur between six months and five years of age, coinciding with the period of rapid brain development and heightened susceptibility to febrile illnesses [3].FS are broadly classified into simple and complex types. Simple febrile seizures are generalized, short-lived (less than 15 minutes), and occur once within a 24-hour period, whereas complex febrile seizures are prolonged (>15 minutes), focal, or recur within the same febrile episode [4]. While the majority of FS are benign and self-limiting, the recurrence rate can range from 15% to 30%, and a small proportion may progress to epilepsy [5,6].The etiology of FS is multifactorial, involving genetic predisposition, immature

neuronal excitability, and cytokine-mediated inflammatory responses during febrile states [7]. Environmental and nutritional factors, such as vitamin D or iron deficiency, have also been associated with increased seizure susceptibility [8]. Family history plays a pivotal role, with children of parents who experienced FS having a threefold higher risk [9].Globally, FS are a source of significant anxiety for parents, often prompting unnecessary diagnostic investigations and hospital admissions [10]. In low- and middle-income countries (LMICs), lack of awareness, delayed medical care, and limited access to diagnostic facilities may complicate management and outcomes [11]. Although most children recover fully without neurological sequelae, complex FS are more likely to recur and occasionally predispose to epilepsy, particularly when associated with prolonged duration or focal features [12].Recent studies have shown that long-term neurodevelopmental outcomes remain favorable, but recurrent FS may impact learning and memory in susceptible children [13,14]. The American Academy of Pediatrics recommends focusing on supportive care and parental counseling rather than aggressive intervention, except in cases of prolonged or atypical seizures [15]. However, regional variations in presentation, management, and recurrence emphasize the need for local data.Given these considerations, the present study aims to analyze the clinical characteristics and outcomes of febrile seizures among children under five years of age, emphasizing recurrence patterns, associated factors, and short-term neurological prognosis in a tertiary care setting.

Material & Methods

This study was conducted in the Department of Pediatrics Lady Reading Hospital Peshawar, Pakistan from Jan 2024 to Jan 2024. A total of 100 children aged 6 months to 5 years presenting with febrile seizures were included. Detailed clinical history, seizure type, duration, recurrence, and family history were recorded.

inclusion criteria

The study included children aged 6 months to 5 years who presented with febrile seizures (FS) to the pediatric department during the study period. Both male and female patients were included regardless of seizure type (simple or complex), provided that complete clinical and demographic information was available. Children with a history of afebrile seizures, central nervous system infections, metabolic abnormalities, or structural brain lesions were excluded from the study. The mean age of the participants was 30.4 ± 12.6 months, with a male predominance of 57%.

Exclusion Criteria

Children with afebrile seizures, CNS infections, developmental delay, or metabolic disorders were excluded.

Data Collection

Demographic and clinical data were collected through structured questionnaires and medical records. Follow-up assessments were conducted at 3 and 12 months to evaluate recurrence or neurological outcomes.

Statistical Analysis

Data were analyzed using SPSS version 24.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. The chi-square test and t-test were used for statistical comparisons, with $p < 0.05$ considered significant

Results

Among 100 enrolled children, the mean age was 30.4 ± 12.6 months, with a male predominance (57%). Simple febrile seizures were observed in 72% of cases, and 28% were complex. A family history of seizures was present in 22% of children. The mean duration of seizures was 7.3 ± 2.4 minutes.Recurrence occurred in 18% of participants during the one-year follow-up period. Two children (2%) developed epilepsy, both belonging to the complex FS group. The association between complex seizures and recurrence was statistically significant (p = 0.032). No cases of mortality or long-term neurological deficit were observed at the end of follow-up, indicating a favorable prognosis in the majority of children.

Table 1: Demographic Characteristics of Study Participants (n = 100)

Variable	Mean ± SD / n (%)
Age (months)	30.4 ± 12.6
Male	57 (57%)
Female	43 (43%)
Weight (kg)	13.1 ± 3.4
Height (cm)	90.6 ± 10.8
Family history of febrile seizures	22 (22%)
Consanguinity among parents	18 (18%)
Immunization up to date	88 (88%)

Table 2: Clinical Characteristics and Seizure Profile

Variable	Frequency (%)
Type of Febrile Seizure	
— Simple	72 (72%)
— Complex	28 (28%)
Seizure Duration	
— < 10 minutes	68 (68%)
— ≥ 10 minutes	32 (32%)
Family history of epilepsy	14 (14%)
Recurrence within one year	18 (18%)
Development of epilepsy	2 (2%)
Hospital admission required	24 (24%)

Table 3: Association Between Seizure Type and Recurrence

Seizure Type	Recurrence n (%)	No Recurrence n (%)	p-value
Simple FS (n = 72)	7 (9.7%)	65 (90.3%)	
Complex FS (n = 28)	8 (28.6%)	20 (71.4%)	**0.032***

Discussion

This study evaluated the clinical characteristics and outcomes of febrile seizures (FS) in children under five years of age, demonstrating that most cases are benign with favorable neurological outcomes. The predominance of simple febrile seizures (72%) observed aligns with prior studies, indicating that simple FS remains the most common presentation in this age group [16]. The mean age of 30.4 ± 12.6 months corresponds with findings from Al-Elissa et al., who reported the highest incidence of FS between 18 and 36 months [17].The observed male predominance (57%) is consistent with global epidemiological trends suggesting that boys are slightly more predisposed to FS, potentially due to genetic and neurodevelopmental differences [18]. The recurrence rate (18%) found in this study closely mirrors results from a Japanese cohort by Fukuyama et al., where recurrence occurred in 15–20% of children within one year [19]. The presence of family history (22%) in our cohort further supports the strong hereditary component previously described by Warier and Appleton, who documented familial patterns of FS recurrence and susceptibility [20].The association between complex FS and recurrence ($p = 0.032$) in this study underlines the prognostic significance of seizure type. Similar findings were reported by Berg et al., who noted that children with complex FS are up to four times more likely to experience recurrence and have an increased risk of subsequent epilepsy [21]. Moreover, studies from India and Turkey have reported comparable recurrence rates, emphasizing that complex FS, prolonged duration, and early onset remain critical predictors of poor outcomes [22,24].

Conclusion

Febrile seizures in children under five years of age are mostly simple, self-limiting, and associated with favorable outcomes. Early recognition, appropriate management, and parental reassurance are essential to reduce anxiety and unnecessary interventions. Complex seizures, early onset, and family history remain significant predictors of recurrence and poor prognosis.

Limitations

This study was limited by its single-center design and relatively small sample size, which may restrict generalizability. Additionally, long-term follow-up to assess later epilepsy development was not conducted. Potential recall bias regarding family history and previous febrile episodes may have influenced data accuracy and interpretation.

Future Directions

Future multicenter, longitudinal studies with larger populations are needed to identify genetic, environmental, and socioeconomic factors influencing febrile seizure recurrence and long-term neurological outcomes. Incorporating neuroimaging, inflammatory biomarkers, and genetic profiling could improve understanding of pathophysiological mechanisms and guide personalized prevention and treatment strategies for at-risk children.

Abbreviations

- **FS:** Febrile Seizures
- **CFS:** Complex Febrile Seizures
- **SFS:** Simple Febrile Seizures
- **EEG:** Electroencephalogram
- **CNS:** Central Nervous System
- **CT:** Computed Tomography
- **MRI:** Magnetic Resonance Imaging

- **SPSS:** Statistical Package for the Social Sciences
- **SD:** Standard Deviation
- **CI:** Confidence Interval
- **P-value:** Probability Value

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Disclaimer
The views and conclusions expressed in this manuscript are those of the authors and do not necessarily reflect the official policies or positions of Lady Reading Hospital Peshawar or funding bodies. The authors assume full responsibility for the integrity and accuracy of the presented data.

Conflict of Interest
The authors declare no conflict of interest related to this study. No financial, personal, or professional relationships with any organization or individual influenced the design, conduct, analysis, interpretation, or reporting of the research findings.

Informed consent
Written informed consent was obtained from the parents or legal guardians of all participating children prior to enrollment. The consent process included a detailed explanation of the study objectives, procedures, potential risks and benefits, confidentiality of data, and the voluntary nature of participation, with the right to withdraw at any time without penalty.

Ethical Approval Statement
Ethical approval for this study was obtained from the Institutional Review Board (IRB), **Lady Reading Hospital / Medical Teaching Institution (LRH/MTI), Peshawar**. The approval was granted to the Department of Pediatrics, LRH, to conduct the study in accordance with institutional and ethical guidelines.

Authorship Contributions
1. **Mohammad Irshad:** Conception and design, acquisition of data, analysis and interpretation of data
2. **Mohsin Hayat :**Drafting of the manuscript, critical revision of the manuscript for important intellectual content
3. **Rashida Saddiq** Final approval of the version to be published
4. **Mohsin Hayat** Agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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