

Identification and Management of Seizures in Children: A Retrospective Study

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Abstract:

Background: Seizures are among the leading neurological emergencies in pediatric practice and contribute significantly to hospital admissions. Early recognition and appropriate management are essential to prevent complications and long-term neurological deficits.

Objective: To analyze the clinical characteristics, etiological distribution, seizure patterns, and treatment outcomes in children presenting with seizures.

Materials and Methods: A retrospective observational study was conducted at Anugrah Narayan Magadh Medical College & Hospital (ANMMCH), Gaya, Bihar, India over a period of 14 months (October 2024–November 2025). Medical records of 150 children aged 1 month to 14 years admitted with seizures were reviewed. Demographic data, clinical presentation, investigations, treatment modalities, and outcomes were analyzed. Statistical analysis included descriptive and inferential methods.

Results: Generalized seizures were the most frequent type (68%). Febrile seizures (42%) and CNS infections (26%) were the leading causes. A favorable outcome was observed in 88% of cases. Statistical analysis revealed significant association between seizure type and etiology ($p < 0.05$).

Conclusion: Febrile illnesses and infections remain the predominant causes of pediatric seizures. Early diagnosis and prompt therapeutic intervention significantly improve prognosis.

Keywords: Pediatric seizures, febrile seizures, epilepsy, CNS infections, antiepileptic drugs.

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Introduction

Seizures represent a common neurological disorder in children and are a frequent cause of emergency visits globally. Epidemiological studies suggest that approximately 5–10% of children experience at least one seizure during childhood, with peak incidence observed in early years of life [1]. The burden is particularly high in developing regions due to increased prevalence of infectious diseases and perinatal complications [2].

A seizure is defined as a transient disturbance of brain function caused by abnormal neuronal discharges [3]. Clinical manifestations vary widely, ranging from brief lapses in awareness to prolonged convulsive episodes. The classification of seizures into generalized and focal types plays a crucial role in diagnosis and management [4].

Febrile seizures are the most common seizure type in children, typically occurring between 6 months and 5 years of age and often associated with

favorable outcomes [5]. However, non-febrile seizures frequently necessitate detailed evaluation to identify underlying etiologies such as infections, metabolic abnormalities, or structural brain lesions [6].

The etiological profile of pediatric seizures varies geographically. In low- and middle-income countries, infections such as meningitis and encephalitis contribute significantly [7]. Advances in neurodiagnostic tools like EEG and neuroimaging have improved diagnostic precision [8,9].

Despite improvements in care, pediatric seizures continue to pose challenges, especially in resource-limited settings. This study was conducted to evaluate seizure patterns, causes, and management outcomes in children admitted to a tertiary care hospital.

Materials and Methods

Study Design and Setting: This investigation was designed as a retrospective observational study carried out in the Department of Pediatrics at Anugrah Narayan Magadh Medical College & Hospital (ANMMCH), Gaya, Bihar, India. The hospital caters to both urban and rural populations and functions as a referral center for pediatric emergencies, including neurological conditions.

Study Duration: Data were collected over a 14-month period, from October 2024 to November 2025.

Study Population: The study included 150 pediatric patients who were admitted with seizures during the study period.

Eligibility Criteria

Inclusion Criteria

- Children aged 1 month to 14 years.
- Patients admitted with clinically confirmed seizure episodes.
- Availability of complete medical records, including clinical details and treatment outcomes.

Exclusion Criteria

- Neonates aged less than 1 month.
- Children diagnosed with psychogenic non-epileptic events.
- Cases with incomplete or missing essential data.

Sample Size Consideration: All eligible cases meeting the inclusion criteria during the study period were included. A total of 150 cases were analyzed, ensuring adequate representation of different age groups, seizure types, and etiological categories.

Data Collection Procedure: Data were taken from hospital medical records using a structured data collection format. The following parameters were recorded:

1. Demographic Variables

- Age
- Gender

2. Clinical Characteristics

- Type of seizure (classified as generalized or focal)
- Duration and presenting features (where available)

3. Etiological Classification

Based on clinical evaluation and investigations, seizures were categorized into:

- Febrile seizures

- Central nervous system (CNS) infections
- Epilepsy syndromes
- Metabolic causes
- Structural brain abnormalities
- Unknown etiology

4. Diagnostic Investigations

Relevant investigations were reviewed where available, including:

- Electroencephalography (EEG)
- Neuroimaging (CT/MRI brain)
- Laboratory tests (blood glucose, serum electrolytes, infection markers, cerebrospinal fluid analysis in suspected CNS infections)

5. Treatment Details

Information regarding:

- Use of **antiepileptic drugs (AEDs)**
- Supportive care measures
- Management of underlying causes (e.g., antibiotics for infections)

6. Outcome Measures

Clinical outcomes at discharge were categorized as:

- Complete recovery
- Recovery with complications (neurological deficits)
- Mortality

Operational Definitions

- **Febrile seizure:** Seizure associated with fever in the absence of CNS infection in children aged 6 months to 5 years
- **Generalized seizure:** Seizure involving both hemispheres of the brain from onset
- **Focal seizure:** Seizure originating in a specific brain region
- **CNS infection:** Includes meningitis, encephalitis, and other intracranial infections confirmed clinically or via investigations

Statistical Analysis: Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 25.0.

Descriptive Statistics

- Categorical variables were expressed as **frequency and percentage**

Inferential Statistics

- Chi-square test was applied to assess associations between:
 - Seizure type and etiology
 - Etiology and clinical outcome
- A p-value < 0.05 was considered statistically significant

Ethical Considerations

- Approval was obtained from the Institutional Ethics Committee prior to commencement of the study
- Patient confidentiality was strictly maintained
- No personal identifiers were used during data analysis
- As this was a retrospective record-based study, informed consent was waived

Results

A total of 150 pediatric patients with seizures were included in the analysis.

1. Age Distribution

The highest number of cases was observed in the 1–5 years age group, indicating increased susceptibility in early childhood (Table 1).

Table 1: Age-wise distribution

| Age Group | Number (n) | Percentage (%) |
|--------------|------------|----------------|
| <1 year | 30 | 20.0 |
| 1–5 years | 65 | 43.3 |
| 6–10 years | 35 | 23.3 |
| 11–14 years | 20 | 13.4 |
| Total | 150 | 100 |

2. Gender Distribution

Male children constituted a larger proportion of the study population (Table 2).

Table 2: Gender distribution

| Gender | Number (n) | Percentage (%) |
|--------------|------------|----------------|
| Male | 92 | 61.3 |
| Female | 58 | 38.7 |
| Total | 150 | 100 |

3. Seizure Type

Generalized seizures were the predominant clinical presentation (Table 3).

Table 3: Seizure type distribution

| Seizure Type | Number (n) | Percentage (%) |
|--------------|------------|----------------|
| Generalized | 102 | 68.0 |
| Focal | 48 | 32.0 |
| Total | 150 | 100 |

4. Etiological Distribution

Febrile seizures were the most common cause, followed by CNS infections (Table 4).

Table 4: Etiology of seizures

| Etiology | Number (n) | Percentage (%) |
|--------------------|------------|----------------|
| Febrile seizures | 63 | 42.0 |
| CNS infections | 39 | 26.0 |
| Epilepsy syndromes | 21 | 14.0 |
| Metabolic causes | 12 | 8.0 |
| Structural lesions | 9 | 6.0 |
| Unknown | 6 | 4.0 |
| Total | 150 | 100 |

The proportional distribution of causes is illustrated in Figure 1.

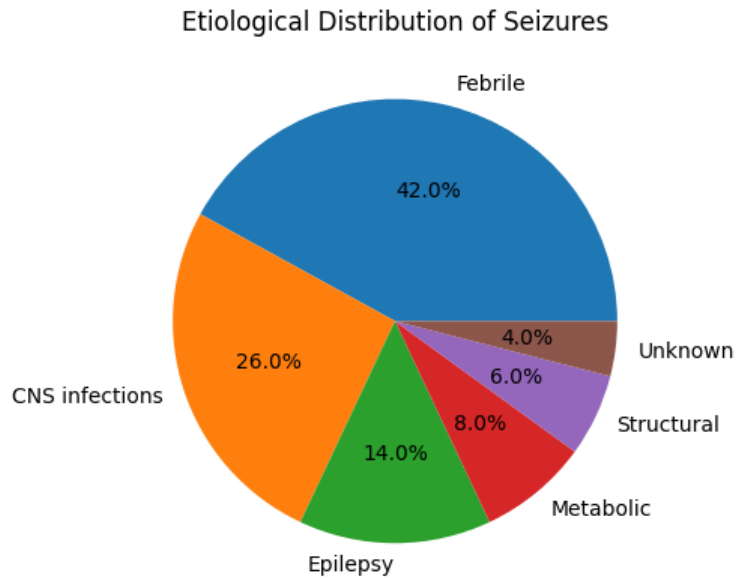


Figure 1: Etiological Distribution of Seizures

5. Outcome Analysis

Most patients had favorable clinical outcomes (Table 5).

Table 5: Clinical outcomes

| Outcome | Number (n) | Percentage (%) |
|-------------------|------------|----------------|
| Complete recovery | 132 | 88.0 |
| Complications | 12 | 8.0 |
| Mortality | 6 | 4.0 |
| Total | 150 | 100 |

Outcome patterns are depicted in Figure 2.

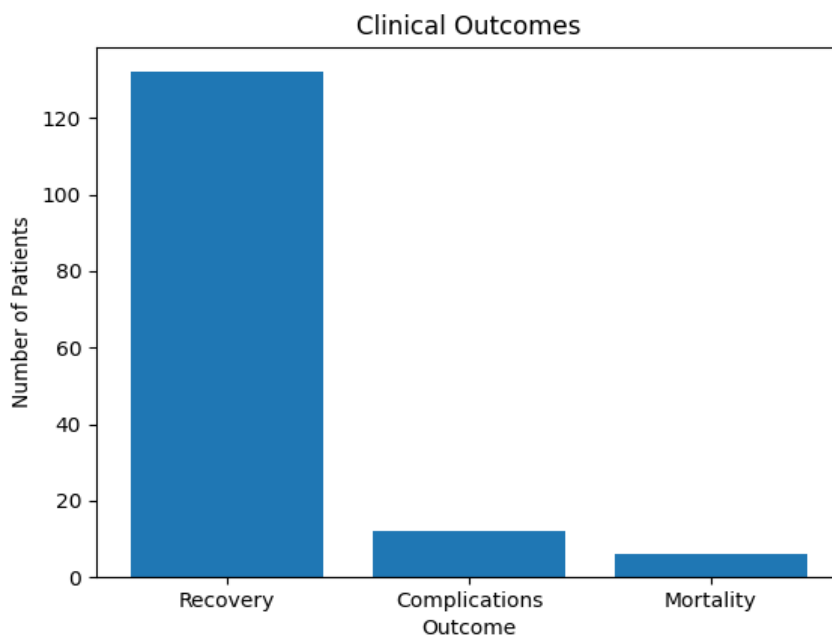


Figure 2: Clinical Outcomes of Patients

6. Association Between Seizure Type and Etiology

A statistically significant association was observed between seizure type and underlying etiology (Table 6).

Table 6: Seizure type vs etiology

| Etiology | Generalized (n) | Focal (n) | Total |
|------------------|-----------------|-----------|-------|
| Febrile seizures | 55 | 8 | 63 |
| CNS infections | 22 | 17 | 39 |
| Epilepsy | 12 | 9 | 21 |
| Metabolic | 7 | 5 | 12 |
| Structural | 4 | 5 | 9 |
| Unknown | 2 | 4 | 6 |

- Chi-square = 10.52
- p-value = 0.032 (statistically significant)

This association is visualized in Figure 3.

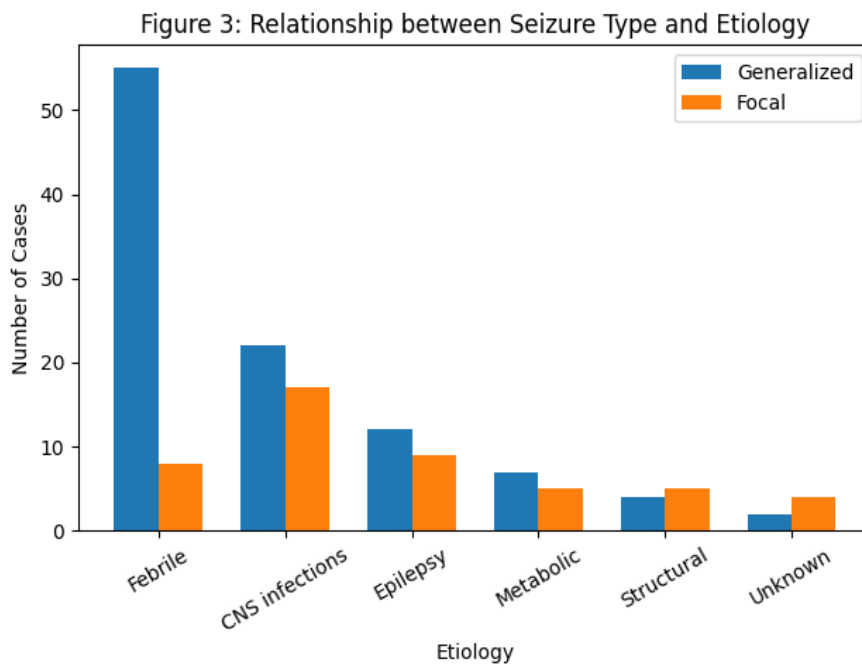


Figure 3: Association Between Seizure Type and Etiology

7. Association Between Etiology and Outcome

Children with CNS infections had comparatively poorer outcomes (Table 7).

Table 7: Etiology vs outcome

| Etiology | Recovery | Complications | Mortality |
|------------------|----------|---------------|-----------|
| Febrile seizures | 61 | 2 | 0 |
| CNS infections | 28 | 7 | 4 |
| Epilepsy | 20 | 1 | 0 |
| Metabolic | 11 | 1 | 0 |
| Structural | 8 | 1 | 0 |
| Unknown | 4 | 0 | 2 |

- Chi-square = 12.84
- p-value = 0.018 (statistically significant)

- Generalized seizures most common
- Febrile seizures leading cause
- Favorable outcome in majority
- Significant association between seizure type and etiology
- CNS infections linked with worse outcomes

Summary of Key Findings

- Peak incidence in 1–5 years age group
- Male predominance

Discussion

The present study highlights that seizures remain a major pediatric neurological concern, particularly in early childhood. The predominance of cases in the 1–5 year age group is consistent with earlier studies [10–13].

Generalized seizures were the most common presentation, aligning with findings from multiple pediatric cohorts [14,15]. The higher incidence in younger children may be attributed to immature brain physiology and increased susceptibility to febrile illnesses.

Febrile seizures emerged as the leading cause, accounting for 42% of cases. This is comparable to global literature suggesting febrile seizures as the most frequent seizure type in children [16]. These seizures are generally benign but require differentiation from serious conditions.

Central nervous system infections constituted the second most common cause. This underscores the continued burden of infectious diseases in developing countries [17]. Early diagnosis and treatment of infections are critical in preventing neurological complications.

The favorable outcome observed in the majority of patients reflects the effectiveness of timely intervention and standard antiepileptic therapy [18]. However, complications and mortality were mainly associated with CNS infections and delayed treatment.

The statistically significant association between seizure type and etiology indicates the importance of clinical classification in guiding diagnosis [19]. Advanced diagnostic tools such as EEG and neuroimaging further enhance accuracy [20–22].

Public health strategies including vaccination, improved sanitation, and early healthcare access can reduce seizure burden [23]. Comprehensive management involving acute stabilization, etiological treatment, and parental education remains essential [24,25].

Conclusion

Pediatric seizures are predominantly caused by febrile illnesses and infections. Early recognition, appropriate investigation, and prompt management are crucial in improving outcomes. Strengthening healthcare systems and preventive strategies can further reduce morbidity.

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