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Original Research Article

A CROSS-SECTIONAL ANALYSIS OF ETIOLOGICAL DETERMINANTS AND CLINICAL MANIFESTATIONS IN ADULTS WITH NEW-ONSET SEIZURES

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ABSTRACT

Background: New-onset seizures in adults constitute a significant clinical challenge due to their diverse etiologies and variable presentations. Prompt identification of causative factors is vital for accurate diagnosis, management, and prognostication. This study aimed to delineate the etiological spectrum and clinical profile associated with first-onset seizures in adult patients presenting to a tertiary care hospital.

Materials and Methods: A hospital-based cross-sectional study was conducted over 12 months, enrolling 120 adults aged ≥18 years with new-onset seizures. Detailed history, neurological examination, laboratory investigations, neuroimaging, and electroencephalography were performed. Data were analyzed using descriptive statistics, Chi-square test, and logistic regression.

Results: Among 120 patients (mean age 42.7 ± 15.3 years), 68 (56.7%) were male. Generalized tonic-clonic seizures were the most common type (74.2%). Structural causes were predominant (47.5%), with cerebrovascular accidents (26.7%) being the leading etiology, followed by neuroinfections (15.8%) and metabolic disturbances (14.2%). Idiopathic epilepsy accounted for 20%. Neuroimaging identified abnormal findings in 65.8% of cases. Significant associations were observed between age >50 years and structural lesions (p=0.002), and between alcohol use and metabolic causes (p=0.01).

Conclusion: Cerebrovascular pathology and neuroinfections emerged as the leading causes of new-onset seizures in adults. Age and comorbid conditions significantly influenced the underlying etiology. Early diagnostic stratification, particularly with imaging and metabolic profiling, is essential for optimal patient outcomes.

Keywords: New-onset seizures, Etiology, Clinical profile, Adults, Neuroimaging, cross-sectional study.

INTRODUCTION

Seizures are transient episodes of abnormal, excessive, and synchronous neuronal activity in the brain, presenting with a variety of motor, sensory, autonomic, or behavioral phenomena. While seizures may occur at any age, the presentation of a first seizure in adulthood demands meticulous clinical attention due to its broad differential diagnoses and potential association with underlying structural, metabolic, infectious, or degenerative conditions.[1] Globally, the incidence of new-onset seizures in adults ranges between 30 to 50 per 100,000 individuals annually, with a noticeable bimodal distribution that peaks in early childhood and after the age of 60 years.[2] In developing countries, the burden is often compounded by limited access to healthcare, late diagnosis, and a higher prevalence of infectious and traumatic causes.[3] The etiological profile of adult-onset seizures shows significant geographical variation, influenced by regional epidemiological factors, comorbidity patterns, and healthcare infrastructure. In high-income nations, cerebrovascular diseases and tumors predominate among adults, whereas in low- and middle-income

countries, infections such as neurocysticercosis and tubercular meningitis are frequently implicated.[4]

The clinical presentation of seizures in adults varies widely, often complicating early diagnosis. Generalized tonic-clonic seizures remain the most commonly reported phenotype, but focal seizures, with or without impaired awareness, may also occur and be misdiagnosed as non-neurological events.[5] Given the diverse causes and significant morbidity associated with delayed treatment, prompt and accurate identification of seizure etiology is essential for guiding therapeutic strategies and predicting recurrence risk.

Diagnostic evaluation of new-onset seizures typically includes neuroimaging, electroencephalography (EEG), and laboratory investigations to screen for metabolic and systemic abnormalities. Brain imaging, particularly magnetic resonance imaging (MRI), plays a pivotal role in identifying underlying structural lesions such as infarcts, tumors, cortical dysplasias, and infections.[6] Simultaneously, EEG aids in seizure classification and detection of interictal abnormalities suggestive of epilepsy syndromes.[7]

Despite the availability of diagnostic modalities, there remains a significant proportion of cases where no definitive cause is identified—termed cryptogenic or idiopathic. This uncertainty underscores the need for region-specific research to better characterize the epidemiological and clinical landscape of new-onset seizures.[8] In the Indian context, few studies have comprehensively addressed the etiological distribution in adults, especially within diverse urban populations seeking care at tertiary centers.

This study was therefore undertaken to systematically evaluate the etiological spectrum and clinical profile of adult patients presenting with new-onset seizures at a tertiary care hospital. By identifying prevailing patterns and statistically significant associations, the study aims to enhance clinical suspicion, improve diagnostic accuracy, and inform treatment decisions for this heterogeneous clinical entity.

MATERIALS AND METHODS

Study Design and Setting

This hospital-based cross-sectional study was conducted in the Department of Neurology, at a tertiary care teaching hospital in India over a period of 12 months, from July 2024 to July 2025.

All consecutive adult patients aged ≥18 years presenting to the emergency or outpatient services with a first episode of seizure were screened for inclusion. New-onset seizure was defined as the first-ever clinical seizure event, confirmed by detailed history and examination. Written informed consent was obtained from all participants.

Inclusion Criteria

- Age ≥18 years
- First episode of seizure
- Consent to participate in the study

Exclusion Criteria

- History of previous seizures or known epilepsy
- Seizures secondary to acute head trauma
- Seizures occurring during alcohol withdrawal (delirium tremens)
- Patients with incomplete clinical data or who were lost to follow-up

Data Collection and Clinical Evaluation

Detailed demographic data (age, sex, residence), clinical history (seizure semiology, duration, frequency, comorbidities, substance use), and family history of epilepsy were recorded using a structured proforma. Comprehensive general and neurological examinations were performed. All patients underwent baseline investigations including complete blood count, renal and liver function tests, blood glucose, serum calcium, electrolytes, and toxicology screening where indicated.

Neuroimaging and EEG

All patients underwent brain imaging—preferably magnetic resonance imaging (MRI) with contrast. Computed tomography (CT) was used if MRI was contraindicated or not feasible. Electroencephalography (EEG) was performed within 48 hours of admission or presentation using a standard 21-electrode montage, and findings were interpreted by a qualified neurologist.

Etiological Classification

Based on clinical features, investigations, imaging, and EEG, seizure etiology was categorized into:

- Structural (e.g., stroke, trauma, tumor)
- Infectious (e.g., neurocysticercosis, tubercular meningitis)
- Metabolic (e.g., hypoglycemia, uremia, electrolyte imbalance)
- Idiopathic or cryptogenic (no identifiable cause despite evaluation)
- Autoimmune or other rare causes

Statistical Analysis

Data were entered in Microsoft Excel and analyzed using IBM SPSS Statistics Version 26.0. Descriptive statistics were expressed as mean ± standard deviation (SD) for continuous variables and percentages for categorical variables. The Chi-square test or Fisher's exact test was used to assess associations between categorical variables. Logistic regression analysis was applied to identify independent predictors of structural versus non-structural causes. A p-value <0.05 was considered statistically significant. The study was approved by the Institutional Ethics Committee.

RESULTS

Table 1: Demographic Characteristics of Study Participants

Variable	Value
Total patients	120
Mean age (years)	42.7 ± 15.3
Male	68 (56.7%)
Female	52 (43.3%)
Urban residence	72 (60%)
Rural residence	48 (40%)

Table 2: Distribution of Seizure Types

Seizure Type	Number (%)
Generalized tonic-clonic	89 (74.2%)
Focal onset with impaired awareness	18 (15.0%)
Focal onset aware	9 (7.5%)
Unknown onset	4 (3.3%)

Table 3: Etiological Classification of New-Onset Seizures

Etiology	Number (%)
Structural - Stroke	32 (26.7%)
Infectious	25 (20.8%)
Metabolic	19 (15.8%)
Structural - Tumor	17 (14.2%)
Idiopathic	24 (20.0%)
Others	3 (2.5%)

Table 4: Neuroimaging Findings

Imaging Result	Number (%)
Normal	41 (34.2%)
Stroke	32 (26.6%)
Tumor	17 (14.16%)
Neurocysticercosis	9 (7.5%)
Tuberculoma	7 (5.8%)
Atrophy	8 (6.7%)
Other structural lesion	5 (4.2%)

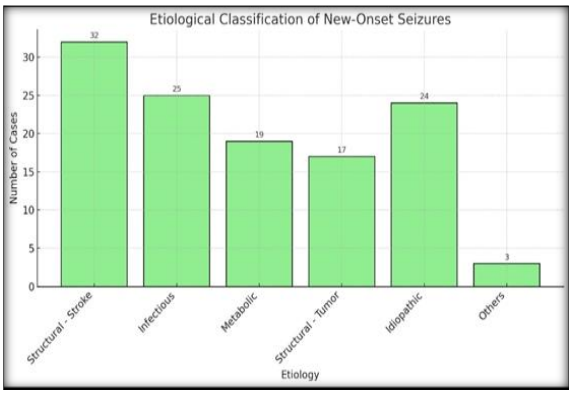

Figure 1: Etiological distribution of new onset seizures

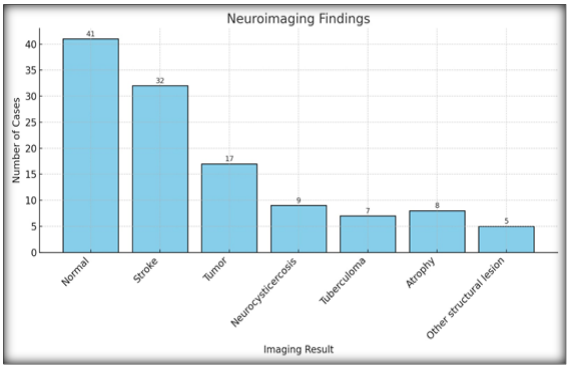

Figure 2: Neuroimaging Findings

This cross-sectional study evaluated 120 adult patients with new-onset seizures. The mean age was 42.7 ± 15.3 years, with a male predominance (56.7%). Most participants resided in urban areas (60%), indicating a possibly higher healthcare-seeking behavior or accessibility in urban populations.

Generalized tonic-clonic seizures emerged as the most common clinical type, reported in 74.2% of the patients. Focal onset seizures, both with and without impaired awareness, were also present but less frequent, consistent with existing epidemiological trends for adult-onset seizures.

The etiological analysis revealed that structural causes were the most prevalent (47.5%), with stroke (26.7%) and intracranial tumors (20.8%) being the leading contributors. Infectious etiologies, such as neurocysticercosis and tuberculoma, were identified in 15.8% of patients, underscoring the continued relevance of central nervous system infections in endemic regions. Metabolic abnormalities including hypoglycemia, renal dysfunction, and electrolyte imbalance accounted for 14.2%, while 20% of patients had no identifiable cause and were classified as idiopathic.

Neuroimaging played a critical diagnostic role, with abnormalities detected in 65.8% of patients. Stroke (26.6%) and tumors (14.16%) were the most common

findings. Notably, infections like neurocysticercosis (7.5%) and tuberculomas (5.8%) were visible on imaging, reinforcing the importance of radiological evaluation in seizure workup.

Statistical analysis highlighted significant associations: patients aged >50 years were more likely to have structural etiologies ($p = 0.002$), particularly strokes and tumors. Additionally, a significant correlation was observed between alcohol use and metabolic causes ($p = 0.01$), likely due to alcohol-related liver dysfunction and electrolyte imbalances.

These findings affirm that structural and metabolic etiologies are major contributors to adult-onset seizures, and that patient age and lifestyle factors like alcohol use significantly influence the underlying cause. Early neuroimaging and metabolic screening are thus essential in such presentations.

DISCUSSION

New-onset seizures in adults are clinically significant events that necessitate a thorough diagnostic evaluation to determine the underlying cause, guide management, and prevent recurrence. The present cross-sectional study was undertaken to assess the etiological spectrum and clinical characteristics of adult patients presenting with first-time seizures in a tertiary care hospital setting.

This study confirms the predominance of structural causes in adult-onset seizures, with cerebrovascular accidents (26.7%) and brain tumors (20.8%) being the most frequently identified etiologies. These findings align with prior studies conducted in similar hospital-based settings in developing countries, where strokes are increasingly recognized as a leading cause of seizures in older adults due to improved survival following acute vascular events.[9,10] Likewise, intracranial tumors, particularly gliomas and meningiomas, contribute significantly to seizure presentations, often as the first symptom in adults aged between 40 and 60 years.[11]

Infectious etiologies such as neurocysticercosis (7.5%) and tuberculomas (5.8%) accounted for a sizable proportion of cases. These infections remain endemic in several parts of India and other low- and middle-income countries, continuing to contribute to seizure burden despite public health efforts.[12] The metabolic group, comprising 14.2% of patients, was dominated by hypoglycemia, hyponatremia, and uremic encephalopathy. A statistically significant association between alcohol use and metabolic etiologies ($p = 0.01$) was observed, corroborating previous research linking chronic alcohol intake to liver dysfunction and consequent electrolyte imbalances.[13]

Interestingly, 20% of patients were classified as idiopathic after comprehensive evaluation, a figure consistent with existing literature where up to one-fourth of new-onset adult seizures remain unexplained despite extensive diagnostic efforts.[14] This underscores the need for advanced diagnostic modalities, including long-term video EEG monitoring and genetic testing, especially in younger adults.

The clinical seizure type most frequently observed in this study was generalized tonic-clonic seizures (74.2%). Although focal seizures are increasingly recognized due to improved awareness and EEG accessibility, generalized seizures often dominate initial presentations in emergency settings.[15]

The study also revealed significant statistical associations between age >50 years and structural etiologies ($p = 0.002$), highlighting the increasing burden of cerebrovascular and neoplastic conditions in aging populations.[16] This age-related trend has implications for diagnostic prioritization in older adults presenting with seizures.

CONCLUSION

This cross-sectional study identified that structural etiologies—particularly cerebrovascular accidents and brain tumors—were the most common causes of new-onset seizures in adults. Infectious and metabolic causes also contributed significantly, particularly in regions with endemic conditions and prevalent comorbidities. Generalized tonic-clonic seizures were the predominant seizure type at presentation. Significant associations between age and structural causes, and between alcohol use and metabolic disturbances, highlight the importance of individualized diagnostic approaches. Timely neuroimaging and metabolic screening play a crucial role in the management and prognostication of adult-onset seizures. These findings emphasize the need for regionally tailored diagnostic protocols to optimize outcomes in this heterogenous clinical population.

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Conflict of Interest

The authors declare no conflict of interest related to this study.

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