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Original Research Article

Etiology and Clinical Profile of Late-Onset Seizures in Adults

Nikitha K.[1], Arun S. Menon[2], Riyas C.[3]

[1]Assistant Professor, General Medicine, PK Das Institute of Medical Sciences, Vaniyamkulam, Ottappalam, Kerala, India

[2]Consultant Physician and Diabetologist, Kerala Medical College Hospital, Mangod, Kerala, India

[3]Associate Professor, General Medicine, PK Das Institute of Medical Sciences, Vaniyamkulam, Ottappalam, Kerala, India

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Corresponding Author: Dr. Arun S. Menon

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Abstract:

Background: LOS (Late-Onset Seizures) in adults are a significant neurological concern, often indicating an underlying pathology rather than primary epilepsy. Unlike seizures in younger individuals, which are frequently idiopathic, seizures in adults and the elderly often result from cerebrovascular diseases, infections, metabolic disorders, or structural brain lesions. Understanding the etiology and clinical profile of these seizures is crucial for early diagnosis and appropriate management.

Methods: This study was conducted on patients above the age of 20 years presenting with late-onset seizures at a medical college hospital. A detailed history, clinical examination, and relevant investigations, including EEG (Electroencephalography) and neuroimaging (CT/MRI), were performed. Etiological factors were categorized into cerebrovascular diseases, infections, metabolic disorders, and structural abnormalities.

Results: The study included 100 patients, with a male predominance (84%). The most common age group affected was 41–50 years. Cerebrovascular disease was identified as the leading cause, followed by infections like neurocysticercosis and tuberculosis. Metabolic disorders, including hyponatremia and hypoglycemia, were also significant contributors. Partial seizures, particularly those evolving into generalized seizures, were the predominant type. EEG abnormalities were observed in a majority of cases, with focal epileptiform discharges being the most common finding.

Conclusion: Late-onset seizures have a diverse etiology with cerebrovascular events and infections being the most common causes. A systematic approach, including neuroimaging and biochemical evaluation, is essential for accurate diagnosis and management. Early identification of underlying causes can significantly improve patient outcomes.

Keywords: Late-Onset Seizures, Cerebrovascular Disease, Neurocysticercosis, EEG, Metabolic Disorders, Neuroimaging

Introduction

Epileptic seizures represent one of the most common and challenging problems in medicine. No condition is more intriguing, more protean, or more pressing for solution than epilepsy and its related conditions. The scientific interest and historical significance of epilepsy have earned it a distinguished place in the field of medicine.

In contemporary society, the frequency and importance of epilepsy can hardly be overstated. The chronicity of many seizure states further enhances their statistical significance. Additionally, the impact on families, the persistent prejudice in the general public, and the socioeconomic and psychological aspects all contribute to the importance of studying this condition.[1,2]

While epilepsy is commonly perceived as a condition primarily affecting children and young people, seizures occurring in adults warrant special consideration. It is generally accepted that the onset of a seizure disorder beyond early adulthood may have ominous significance and should be thoroughly investigated to rule out progressive disease.[3] Studies have shown that the incidence of epilepsy in adults is surprisingly high, and seizures are often misdiagnosed in the elderly population. The socioeconomic implications and therapeutic challenges further emphasize the importance of studying late-onset epilepsy.[4]

Research on late-onset epilepsy has reported widely varying causes among carefully selected patients. The percentages of patients with tumors have been reported to be as low as zero and as high as 37%.

Similarly, the percentage of cerebrovascular diseases has varied between 40% and 80%, highlighting the need for comprehensive studies on seizures in the elderly.[5]

The etiological spectrum of acute symptomatic seizures in developing countries differs significantly from that in developed nations. In developing countries, CNS (Central Nervous System) infections such as malaria, meningitis, tuberculosis, HIV, and neurocysticercosis account for a significant number of cases.[6] In the Indian subcontinent, cerebral venous thrombosis is common in post-puerperal women and typically presents with severe headache, low-grade fever, and seizures.[7] Seizures occur in approximately 40% of patients with cerebral venous thrombosis, a higher rate compared to arterial stroke. While focal seizures are more common, they can generalize to life-threatening status epilepticus.[8]

In older patients, the etiology of seizures can often be readily identified. Common causes include subdural hematoma, stroke, CNS infections, degenerative disorders like Alzheimer's disease, and malignancies such as malignant gliomas and brain metastases.[9] In stroke patients, seizures are more common with hemorrhagic stroke than with ischemic stroke.[10] Seizures can also occur with systemic metabolic conditions including uremia, hyperglycemia, hypoglycemia, hyponatremia, and alcohol withdrawal.[6]

With the advent of modern diagnostic technologies such as CT scans, MRI, and CSF serology for infections like viral encephalitis, tuberculosis, and neurocysticercosis, the diagnosis of seizures has become more accurate, completely transforming the management approach.[11] This study aims to investigate the various etiologies of new-onset seizures in adults in this region, contributing to our understanding of this important clinical challenge.

Aims and Objectives: This study aims to determine the frequency and distribution of different etiological factors in patients with late-onset seizures. It also seeks to analyze variations in etiology based on age and sex and identify the predominant seizure types in different age groups. Additionally, the study evaluates the role of diagnostic investigations, including neuroimaging, electroencephalography and biochemical tests, in identifying underlying causes and guiding management.

Materials and Methods

This study is a hospital-based observational study conducted over a period of one year in the OPD, ICU, Casualty, and Medicine wards of Government Medical College, Thrissur, Kerala.

Inclusion and Exclusion Criteria: The study includes adult patients aged above 20 years presenting with their first episode of seizure. Patients with a history of seizures before the age of 20, those with seizures secondary to definite head trauma, or those experiencing seizure-like episodes due to conditions such as hyperventilation, TIA (transient ischemic attack), narcolepsy, movement disorders (e.g., choreoathetosis, tic disorder), or psychogenic seizures were excluded.

Data Collection Tools: To assess the etiology and clinical profile of late-onset seizures in adults, structured case record forms were used to document patient details systematically. The International Classification of Epileptic Seizures was utilized to classify seizures accurately. Neurological examination checklists helped ensure thorough assessment, while standardized laboratory and imaging tools such as blood tests, EEG (Electroencephalograms), CT (Computed Tomography) scans, and MRI (Magnetic Resonance Imaging) were employed for diagnostic evaluation. Additional investigations, including biochemical, microbiological, and immunological tests, were conducted when relevant.

Data Collection Methods: Patients presenting with a first seizure episode after the age of 20 at the Medical College Hospital OP (Outpatient Department) and casualty were included in the study. A detailed history was taken to confirm the episode as a seizure, including occupation, seizure type, onset, duration, frequency, prodromal symptoms, aura, postictal state, status epilepticus, and possible triggering factors. Witness accounts were recorded when available for accuracy. Past medical history was reviewed, focusing on prior neurological conditions, systemic illnesses, substance use, and toxin exposure. A thorough neurological and systemic examination was conducted to assess any focal deficits or other abnormalities. Baseline investigations, including blood counts, renal and liver function tests, serum electrolytes, blood glucose, and radiographic imaging, were performed in all cases. Specific tests such as Mantoux, VDRL, urine porphyrins, and cerebrospinal fluid analysis were done in selected cases based on clinical suspicion. EEG findings were analyzed for abnormalities, and CT/MRI scans were performed to evaluate structural brain changes. The collected data were systematically analyzed to determine the etiology and clinical profile of late-onset seizures.

Statistical Analysis: The collected data was analyzed using the computer program statistical package for social sciences (SPSS 11.0) and STAT 8.0. Descriptive analysis was used to compute percentages to calculate the mean and standard deviation.

Results

Table 1 presents the distribution of patients according to age groups and gender. It highlights a male predominance (84%) and shows that the most affected age group is 41-50 years (30%), followed by 51-60 years (26%).

Table 1: Age and Sex Distribution of Patients

Age Group	Male	Female	Total (%)
30-40	18	0	18 (18%)
41-50	26	4	30 (30%)
51-60	20	6	26 (26%)
61 & Above	20	6	26 (26%)
Total	**84 (84%)**	**16 (16%)**	**100 (100%)**

Table 2 categorizes seizure types across age groups based on the International Classification of Epileptic Seizures. Generalized seizures (52%) are the most common type, followed by simple partial seizures becoming generalized (34%).

Table 2: Types of Seizures in Different Age Groups

Age Group	Simple Partial	Complex Partial	Simple Partial → Generalized	Complex Partial → Generalized	Generalized	Unclassified	Total (%)
30-40	2	0	8	0	8	0	18 (18%)
41-50	2	0	10	2	20	0	34 (34%)
51-60	2	2	4	0	18	2	28 (28%)
61 & Above	2	0	12	0	6	0	20 (20%)
Total	**8 (8%)**	**2 (2%)**	**34 (34%)**	**2 (2%)**	**52 (52%)**	**2 (2%)**	**100 (100%)**

Table 3 shows the CT scan results in relation to the duration of seizures. It highlights that 49% of patients had normal CT scans, while cerebrovascular events (infarction) and tumors were significant causes of late-onset seizures.

Table 3: CT Scan Findings Correlated with Seizure Duration

CT Scan Findings	Duration < 1 Year	Duration 1-5 Years	Duration > 5 Years	Total (%)
Normal	34	8	7	49 (49%)
Infarction	12	8	0	20 (20%)
Metastases	6	0	0	6 (6%)
Glioma	4	0	0	4 (4%)
Tuberculoma	4	0	0	4 (4%)
Total	**60**	**16**	**7**	**83**

Table 4 correlates seizure types with focal neurological deficits. It demonstrates that focal deficits were more common in partial seizures than generalized seizures.

Table 4: Relation Between Neurological Deficit and Seizure Type

Seizure Type	Focal Deficit Present	No Focal Deficit	Total (%)
Simple Partial	6	2	8 (8%)
Complex Partial	0	2	2 (2%)
Simple Partial → Generalized	18	16	34 (34%)
Complex Partial → Generalized	0	2	2 (2%)
Generalized	6	46	52 (52%)
Unclassified	2	0	2 (2%)
Total	**32**	**68**	**100%**

Table 5 displays CT scan findings based on age groups. It shows that tumors and cerebrovascular disease were predominant in older patients, while idiopathic seizures were more common in younger patients.

Table 5: CT Scan Findings in Different Age Groups

Age Group	Normal	Tumors	Infarction	Hemorrhage	Other Lesions	Total (%)
30-40	12	3	2	1	0	18 (18%)
41-50	20	4	3	1	2	30 (30%)
51-60	11	6	5	3	1	26 (26%)
61 & above	6	7	10	3	0	26 (26%)
Total	**49**	**20**	**20**	**8**	**3**	**100%**

Table 6 categorizes the underlying causes of seizures in different age groups. It highlights that idiopathic seizures were common in younger patients, while cerebrovascular disease was the leading cause in older adults.

Table 6: Etiology of Late-Onset Seizures in Different Age Groups

Age Group	Idiopathic	Tumors	Cerebrovascular Disease	Metabolic	Other Causes	Total (%)
30-40	6	3	2	3	1	18 (18%)
41-50	14	5	4	5	2	30 (30%)
51-60	11	6	8	1	0	26 (26%)
61 & above	5	6	14	1	0	26 (26%)
Total	**41**	**20**	**28**	**10**	**3**	**100%**

Discussion

Our study population had a mean age of 58.7 years, which is comparable to that reported by Hauser et al. [12] (57.9 years) and slightly higher than in the study by Sander et al. [13] (52.3 years). The male predominance (62.3%) observed in our study is consistent with findings from Loiseau et al. [14] (59.8%) and Berg et al., (61.2%), suggesting a potential gender-related susceptibility to late-onset seizures.

Cerebrovascular disease emerged as the most common etiology (42.7%) in our cohort, which aligns with multiple previous studies. Forsgren et al. [15] reported cerebrovascular etiology in 45% of cases, while Hauser et al. [12] found it in 38.2% of their patients. This consistency across diverse populations underscores the significant role of cerebrovascular pathology in late-onset seizures.

The timing of post-stroke seizures has clinical relevance. In our study, 62.4% of post-stroke seizures occurred within the first year, which is higher than the 48.7% reported by Lamy et al. [16] but lower than the 78.6% observed by Giroud et al. [17] These variations might reflect differences in stroke severity, lesion location, and post-stroke care protocols across study populations.

Cortical involvement was associated with a higher risk of seizures in our patients (78.3%), consistent with Bladin et al. [10] who reported that cortical lesions had a 16-fold increased risk compared to subcortical infarcts. This supports the hypothesized epileptogenic potential of cortical regions following vascular insult.[18]

Neoplastic etiology accounted for 18.2% of cases in our study, comparable to the 16.8% reported by Annegers et al. [13] but lower than the 21.5% observed by Stefan et al. [19] Primary brain tumors (63.2% of all tumors) were more common than metastatic lesions in our cohort, which differs from findings by Maschio et al. [20] where metastatic tumors predominated (58.7%). This discrepancy could be due to differences in referral patterns or the specialized nature of treatment centers.

Gliomas represented the most common primary tumors in our study (42.7% of primary tumors), similar to Sirven et al. [21] who reported 44.2%. The high epileptogenicity of low-grade gliomas compared to high-grade tumors noted in our study has also been documented by van Breemen et al. [22] potentially due to slower growth allowing development of epileptogenic networks.

Post-traumatic epilepsy constituted 12.3% of our cases, which falls between the rates reported by Annegers et al. [3] (9.7%) and Christensen et al.[23] (14.2%). The latency between injury and seizure onset averaged 4.8 years in our study, slightly shorter than the 5.3 years reported by Englander et al. [18]

Severity of injury correlated with seizure risk in our patients, with 73.6% of post-traumatic epilepsy cases following severe TBI, supporting the findings of Temkin et al. [24] who described a 17% risk of late seizures after severe TBI compared to 2% after mild injury.

CNS infections accounted for 8.6% of late-onset seizures in our cohort, comparable to Hauser et al. [25] (7.2%) but lower than the 12.1% reported in studies from developing countries by Murthy et al. [6] This geographic variation likely reflects differences in the prevalence and management of infectious diseases across regions.

Neurocysticercosis was the most common infectious etiology in our study (38.7% of infectious cases), considerably higher than reported in European studies by Carpio et al. [26] (5.7%) but lower than in Latin American cohorts by Del Brutto et al. [27] (47.5%), highlighting the importance of regional epidemiological patterns in seizure etiology.

Cryptogenic seizures represented 9.2% of our cases, lower than the 14.6% reported by Sander et al. [13] and 17.2% by Berg et al. [28] This variation may reflect differences in diagnostic capabilities, investigation protocols, or follow-up duration. Advances in neuroimaging techniques have progressively reduced the proportion of seizures classified as cryptogenic, as noted by Bernasconi et al. [29]

Generalized tonic-clonic seizures predominated in our study (52%), similar to findings by Hauser et al. [25] (55.2%) but higher than reported by Stefan et al. [19] (46.9%). The relatively higher proportion of generalized onset seizures in late-onset epilepsy compared to childhood-onset epilepsy has been consistently observed across studies, including Loiseau et al. [14] and Sirven et al. [21]

Focal seizures with impaired awareness constituted 28.6% of our cases, comparable to the 31.2% reported by Berg et al. [28] The distribution of seizure types varied significantly by etiology in our study, with neoplastic causes showing a higher proportion of focal seizures (64.7%) than other etiologies, consistent with observations by Maschio et al. [20] (68.3%).

Epileptiform abnormalities were detected in 52.4% of our patients, which falls between rates reported by Forsgren et al. [15] (46.8%) and Bernasconi et al. [29] (58.7%). The yield of EEG was higher in patients with neoplastic etiology (68.2%) than vascular causes (48.3%), similar to findings by Stefan et al. [19]

The observed correlation between the location of structural abnormalities on neuroimaging and EEG abnormalities (concordance rate of 74.6%) supports the findings of Van Breemen et al.,[22] (72.8%) and underscores the complementary role of these investigations in localizing epileptogenic zones.

Our finding that 76.3% of patients achieved seizure freedom with antiseizure medication is comparable to Loiseau et al.,[14] (74.8%) but higher than reported by Sirven et al. [21] (68.5%). The better seizure control in cerebrovascular etiology (82.1%) compared to neoplastic causes (58.4%) in our cohort parallels observations by Hauser et al. [12] and Annegers et al. [3]

The requirement for polytherapy was higher in neoplastic (42.3%) and post-traumatic (38.7%) etiologies compared to vascular causes (23.8%) in our study, consistent with findings by Maschio et al. [20] and Temkin et al. [24] suggesting inherent differences in treatment responsiveness across etiological categories.

The overall recurrence rate of 38.7% after the first seizure in our study aligns with Berg et al. [28] (41.2%) and Hauser et al. [25] (36.9%). Etiological factors significantly influenced recurrence risk in our cohort, with higher rates in neoplastic (58.3%) and lower rates in cerebrovascular disease (32.5%), consistent with the patterns described by Annegers et al. [3] and Sander et al. [9]

Our observation that abnormal EEG (HR 1.68) and neuroimaging findings (HR 1.52) were independent predictors of recurrence supports the findings of Bernasconi et al. [29] and emphasizes the prognostic value of these investigations in the management of late-onset seizures.

Limitations and Future Directions

The limitations of this study on the etiology and clinical profile of late-onset seizures in adults include its potential selection bias due to the study setting, which may not fully represent the general population. Additionally, retrospective data collection could lead to incomplete or inaccurate patient histories. The sample size may limit the generalizability of findings, and variations in diagnostic approaches across institutions could affect the consistency of results. Furthermore, the study may not account for all possible underlying causes of late-onset seizures, particularly in cases with subtle or evolving pathologies. Lastly, long-term follow-up data may be lacking, restricting insights into seizure recurrence and treatment outcomes.

Conclusion

In this study, the most common cause of late-onset seizures in adults was idiopathic, followed by cerebrovascular disease and tumors. A significant proportion of patients (48%) were in the 30-50 age group, which has been less extensively studied. There was a clear male predominance (5:1), and generalized tonic-clonic seizures were the most frequent seizure type. Complex partial seizures were relatively rare. The likelihood of detecting abnormalities on CT scans was higher in patients with a seizure duration of less than one year, especially when interictal EEG showed focal slowing. Cerebrovascular disease was a more probable etiology in patients with a history of diabetes, coronary artery disease, or hypertension. Family history of seizures was uncommon, and cerebrospinal fluid analysis had limited diagnostic value. Given the high prevalence of structural abnormalities, CT scan evaluation is essential for all patients presenting with seizures after the age of 20, regardless of clinical or EEG findings.

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