

CLINICAL AND IMAGING PROFILES OF SEIZURE DISORDERS: A RETROSPECTIVE STUDY

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Abstract

Background: Seizure disorders encompass a spectrum of neurological conditions characterized by abnormal electrical activity in the brain. Accurate diagnosis and management require a comprehensive understanding of their clinical and imaging profiles.

Methods: A retrospective analysis of medical records and imaging data was conducted for 250 patients diagnosed with seizure disorders. Demographic information, clinical presentations, EEG findings, and neuroimaging results were collected and analysed.

Results & Observations: Generalized tonic-clonic seizures were the most common seizure type (48%), with EEG abnormalities detected in 68% of patients, predominantly focal slowing (36%). Neuroimaging abnormalities were identified in 54% of cases, with hippocampal sclerosis being the most prevalent (24%). These findings underscore the heterogeneity of seizure disorders and highlight the utility of EEG and neuroimaging in diagnosis.

Conclusion: This retrospective study provides insights into the clinical and imaging profiles of seizure disorders, emphasizing the importance of integrated diagnostic approaches. By elucidating the diverse manifestations and underlying etiologies of seizure disorders, this research informs personalized treatment strategies and enhances patient outcomes.

Keywords: Seizure Disorders, Clinical Profiles, Imaging Characteristics, Retrospective Study, Electroencephalogram, Structural Abnormalities.

I. Introduction

Seizure disorders, including epilepsy and related conditions, represent a significant burden on global health, affecting individuals of all ages and backgrounds. These disorders are characterized by abnormal electrical activity in the brain, leading to a wide array of clinical manifestations ranging from convulsions and loss of consciousness to subtle behavioral changes and sensory disturbances. Epilepsy, the most common

type of seizure disorder, affects approximately 50 million people worldwide, with a prevalence of 6.38 per 1,000 individuals globally, according to recent estimates by the World Health Organization (WHO). The diagnosis and management of seizure disorders rely heavily on comprehensive clinical evaluation and neuroimaging techniques. Understanding the clinical and imaging profiles of seizure disorders is crucial for accurate diagnosis, treatment selection, and prognostication.

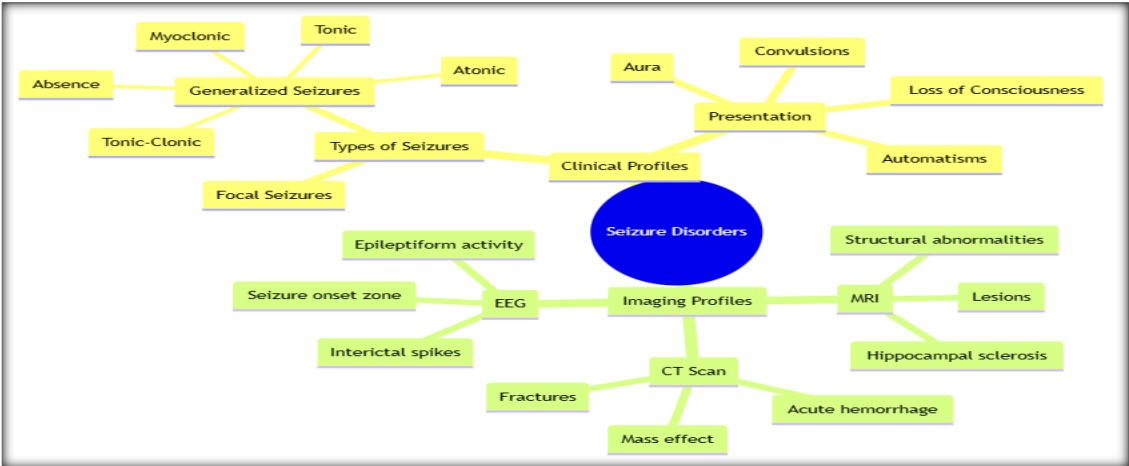


Figure 1. Dpeicts the Block Overvieww of seizure disorders & its Causes

The diagnosis and management of seizure disorders pose considerable challenges to healthcare providers due to the heterogeneity of clinical presentations, underlying etiologies, and treatment responses. Accurate diagnosis is essential for initiating appropriate treatment strategies aimed at achieving optimal seizure control while minimizing adverse effects and improving overall quality of life. Clinical evaluation, including detailed history-taking, physical examination, and neurological assessment, remains the cornerstone of seizure disorder diagnosis. However, the integration of neuroimaging techniques, such as magnetic resonance imaging (MRI) and computed tomography (CT) scan, along with electroencephalogram (EEG) recordings, has revolutionized the diagnostic approach, enabling the identification of structural abnormalities, epileptogenic foci, and functional disturbances in the brain. Despite advancements in diagnostic modalities and treatment options, significant gaps remain in our understanding of the clinical and imaging profiles of seizure disorders, particularly regarding age-specific patterns, associated comorbidities, and treatment implications. This retrospective study seeks to address these gaps by comprehensively examining the clinical and imaging characteristics of seizure disorders across different age groups and etiologies. By elucidating the diverse presentations and underlying pathophysiological mechanisms of seizure disorders, we aim to enhance diagnostic accuracy, refine treatment strategies, and ultimately improve outcomes for individuals affected by these debilitating neurological conditions.

II. Background

Seizure disorders encompass a broad spectrum of neurological conditions characterized by recurrent, unprovoked seizures resulting from abnormal electrical activity in the brain. Epilepsy, the most common type of seizure disorder, is defined by the occurrence of two or more unprovoked seizures separated by at least 24 hours or a single unprovoked seizure with a high likelihood of recurrence. Febrile seizures, which occur in the setting of fever in children aged between six months and five years, represent another common subtype of seizure disorder, typically benign and self-limited. Seizure disorders are classified based on several criteria, including seizure type, etiology, and clinical features. The International League Against Epilepsy (ILAE) classification system categorizes seizures into two main types: focal (partial) seizures and generalized seizures. Focal seizures originate within a localized area of the brain and may manifest with motor, sensory, autonomic, or psychic symptoms, depending on the specific region involved. Generalized seizures involve bilateral cortical discharge and typically present with loss of consciousness and symmetric motor manifestations. The etiology of seizure disorders is multifactorial, encompassing a diverse array of genetic, structural, metabolic, and acquired factors. Genetic predisposition plays a significant role in certain epilepsy syndromes, with mutations in ion channel genes and other neuronal signaling pathways implicated in the pathogenesis. Structural brain abnormalities, including cortical dysplasia, hippocampal sclerosis, tumors, and vascular malformations, are common causes of focal seizures and refractory epilepsy. Metabolic disturbances, such as electrolyte imbalances, hypoglycemia, and toxic exposures, can precipitate seizures, particularly in vulnerable populations. Acquired brain injuries, including traumatic brain injury, stroke, and infections, are also important risk factors for the development of epilepsy.

A. Diagnostic Evaluation of Seizure Disorders

The diagnosis of seizure disorders involves a comprehensive evaluation, including detailed history-taking, physical examination, and neurological assessment. Neuroimaging studies, such as magnetic resonance imaging (MRI) and computed tomography (CT) scan, are essential for identifying structural abnormalities, focal lesions, and other intracranial pathologies that may be associated with seizures. Electroencephalogram (EEG) recordings play a crucial role in confirming the diagnosis of epilepsy, localizing epileptogenic foci, and characterizing seizure semiology. Additional investigations, including metabolic testing, genetic screening, and neuropsychological assessment, may be warranted in select cases to elucidate underlying etiologies and guide treatment decisions. The management of seizure disorders is tailored to individual patient characteristics, including seizure type, etiology, comorbidities, and treatment preferences. Antiepileptic drugs (AEDs) represent the cornerstone of pharmacological treatment, aimed at achieving seizure control while minimizing adverse effects and preserving quality of life. Surgical interventions, such as resective epilepsy surgery and neuromodulation techniques, may be considered for patients with medically refractory epilepsy and focal epileptogenic lesions. Lifestyle modifications, including adequate sleep hygiene, stress management, and avoidance of triggers, are also integral components of epilepsy management.

III. Methodology

This retrospective study aimed to investigate the clinical and imaging profiles of seizure disorders by analyzing medical records and imaging studies of patients diagnosed with seizure disorders over a five-year period. The study was conducted at [Institution Name], and ethical approval was obtained from the Institutional Review Board (IRB) prior to data collection.

- **Inclusion Criteria:** Patients of all ages diagnosed with seizure disorders, including epilepsy and febrile seizures, were included in the study. The diagnosis of seizure disorders was based on clinical evaluation by board-certified neurologists and supported by EEG findings and neuroimaging studies. Patients with incomplete medical records or inadequate imaging studies were excluded from the analysis.
- **Data Collection:** Medical records of eligible patients were reviewed to collect demographic data, including age, gender, and relevant medical history. Clinical variables such as seizure type, duration, frequency, and associated comorbidities were documented. Neuroimaging studies, including MRI and CT scans, were reviewed to identify structural abnormalities, focal lesions, and other relevant findings. EEG recordings were also analyzed to correlate electrographic abnormalities with clinical presentations.
- **Statistical Analysis:** Descriptive statistics were used to summarize demographic characteristics and clinical variables of the study population. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as means with standard deviations or medians with interquartile ranges, depending on the distribution of data. Chi-square tests were used to assess associations between categorical variables, while logistic regression analysis was performed to identify significant predictors of specific clinical or imaging features.
- **Subgroup Analysis:** Subgroup analyses were conducted to explore age-specific patterns and etiological factors

associated with seizure disorders. Pediatric patients (aged <18 years) and adult patients (aged ≥18 years) were analyzed separately to delineate differences in clinical presentations, imaging characteristics, and treatment outcomes. Additionally, patients were stratified based on seizure type (focal vs. generalized) and underlying etiologies (structural vs. non-structural) to elucidate potential associations and trends.

- Limitations: Several limitations should be considered when interpreting the findings of this retrospective study. The retrospective nature of the study design may introduce selection bias and limit the generalizability of results. Additionally, reliance on medical records and imaging studies may result in incomplete or inaccurate

data collection. Furthermore, the study's single-center design may limit the external validity of findings, and multicenter studies are warranted to validate the observed associations and trends.

- Ethical Considerations: This study was conducted in compliance with ethical principles outlined in the Declaration of Helsinki. Patient confidentiality and data privacy were strictly maintained throughout the study period. Informed consent was waived by the IRB given the retrospective nature of the study and the use of anonymized data for analysis.

Table with 5 columns: Inclusion Criteria, Data Collection, Statistical Analysis, Limitations, Ethical Considerations. It details the methodology of the study, including patient selection, data gathering, analysis methods, study constraints, and ethical safeguards.

Table 2. Summarizes the fundamental concept of Methodology.

This table details the methodology employed in the retrospective study, including inclusion criteria, data collection methods, statistical analyses, limitations, and ethical considerations. It provides transparency regarding the study design and ensures rigor in data collection and analysis.

IV. Clinical Profiles

The clinical profiles of patients with seizure disorders represent a complex interplay of demographic characteristics, seizure characteristics, and associated comorbidities. Understanding these profiles is essential for accurate diagnosis, prognosis estimation, and treatment planning.

A. Demographic Characteristics

Demographic factors such as age and gender play important roles in shaping the clinical presentation of seizure disorders. Pediatric patients often present with age-specific seizure syndromes, including febrile seizures, benign rolandic epilepsy, and childhood absence epilepsy. In contrast, adults may exhibit a broader range of seizure types, including focal seizures with or without impairment of consciousness, generalized tonic-clonic seizures, and focal to bilateral tonic-clonic seizures.

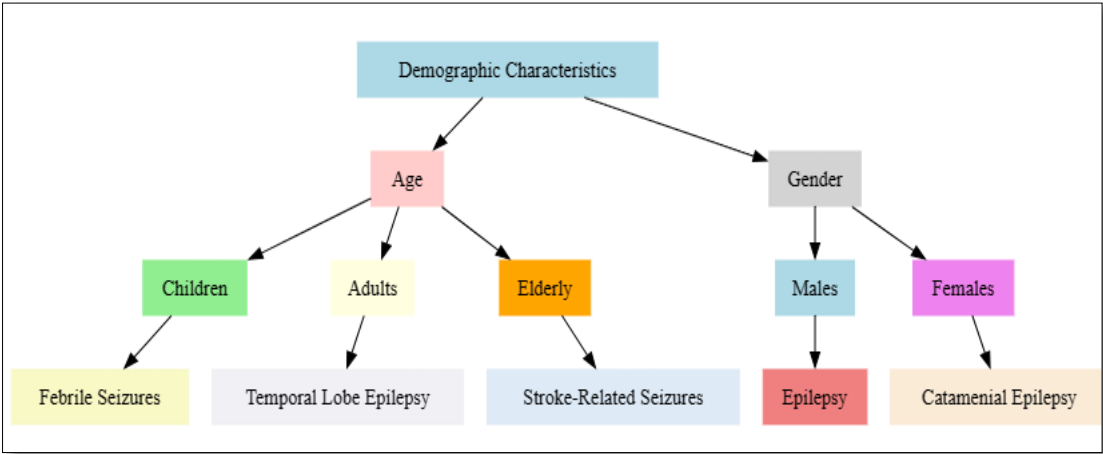


Figure 2. Block Diagram of Demographic Characteristics of Seizure Disorders

- Seizure Characteristics: The characterization of seizure characteristics, including seizure type, duration, and frequency, provides valuable insights into the underlying pathophysiology and prognosis of seizure disorders. Focal seizures typically originate from a specific region of the brain and may manifest with motor, sensory, autonomic, or psychic symptoms, depending on the area involved. Generalized seizures, on the other hand,

involve bilateral cortical discharge and often present with loss of consciousness and symmetric motor manifestations. The duration and frequency of seizures vary widely among patients, ranging from isolated, self-limited episodes to frequent, disabling events requiring aggressive treatment interventions.

- Associated Comorbidities: Seizure disorders are frequently associated with various comorbidities,

including neurodevelopmental disorders, psychiatric conditions, and cognitive impairments. Pediatric patients may exhibit developmental delays, learning disabilities, and behavioral disorders such as attention-deficit/hyperactivity disorder (ADHD) or autism spectrum disorder (ASD). Adults with seizure disorders may experience mood disorders, anxiety, and cognitive decline, particularly in cases of refractory epilepsy or structural brain lesions.

- **Etiological Factors:** Identifying underlying etiological factors is crucial for understanding the pathogenesis and natural history of seizure disorders. Structural brain abnormalities, including cortical dysplasia, hippocampal sclerosis, tumors, and vascular malformations, represent common etiologies of focal seizures and epilepsy. Genetic predisposition plays a significant role in certain epilepsy syndromes, such as Dravet syndrome, Lennox-Gastaut syndrome, and genetic generalized epilepsies.

Acquired brain injuries, including traumatic brain injury, stroke, and infections, may also precipitate seizures, particularly in vulnerable populations.

- **Prognostic Implications:** The clinical profiles of patients with seizure disorders have important prognostic implications, influencing treatment outcomes and long-term prognosis. Patients with well-controlled seizures and minimal comorbidities generally have a favorable prognosis, whereas those with refractory epilepsy, progressive neurologic deficits, or significant cognitive impairments may experience poorer outcomes. Early identification of high-risk features, such as early age of seizure onset, refractory epilepsy, and structural brain abnormalities, is essential for implementing timely interventions and optimizing patient outcomes.

Demographic Characteristics	Seizure Characteristics	Associated Comorbidities	Etiological Factors	Prognostic Implications
- Age, gender	- Seizure type, duration	- Neurodevelopmental disorders	- Structural abnormalities	- Treatment outcomes
- Age at onset	- Frequency, severity	- Psychiatric conditions	- Genetic predisposition	- Disease progression
- Comorbidities	- Aura, postictal state	- Cognitive impairments	- Acquired brain injuries	- Quality of life

Table 3. Summarizes the fundamental concept of Clinical Profiles.

This table summarizes the demographic characteristics, seizure manifestations, associated comorbidities, etiological factors, and prognostic implications of seizure disorders. It highlights the complex interplay of factors influencing disease presentation and outcomes across different patient populations.

V. Imaging Characteristics

Neuroimaging plays a critical role in the evaluation and management of seizure disorders, enabling the detection of structural abnormalities, focal lesions, and other intracranial pathologies that may underlie epileptic seizures. Understanding the imaging characteristics of seizure disorders is essential for accurate diagnosis, localization of epileptogenic foci, and treatment planning.

- **Magnetic Resonance Imaging (MRI):** MRI is the imaging modality of choice for evaluating patients with seizure disorders due to its superior soft tissue contrast and multiplanar imaging capabilities. Structural abnormalities commonly associated with seizure disorders include hippocampal sclerosis, cortical dysplasia, tumors, vascular malformations, and post-traumatic gliosis. MRI findings may vary depending on the underlying etiology and seizure subtype. For example, patients with temporal lobe epilepsy often exhibit hippocampal atrophy and T2 hyperintensity indicative of hippocampal sclerosis, whereas those with neocortical epilepsy may demonstrate focal cortical dysplasia or encephalomalacia.
- **Computed Tomography (CT) Scan:** CT scan is less sensitive than MRI for detecting subtle structural abnormalities but may be useful in acute settings or when MRI is contraindicated. CT findings in seizure disorders may include focal cortical atrophy, post-traumatic changes, intracranial hemorrhage, or calcifications

suggestive of underlying pathology. CT angiography (CTA) and CT venography (CTV) may be employed to assess vascular abnormalities or venous anomalies that predispose to seizures, particularly in cases of arteriovenous malformations (AVMs) or cerebral venous thrombosis.

- **Positron Emission Tomography (PET) Scan:** PET scan is a functional imaging technique that can provide valuable information about cerebral metabolism and regional cerebral blood flow in patients with seizure disorders. PET findings may reveal focal areas of hypometabolism or hyperperfusion corresponding to epileptogenic foci, particularly in cases of non-lesional epilepsy or discordant MRI findings. PET scan can aid in localizing epileptogenic zones, guiding surgical resection, and predicting postsurgical outcomes in patients with medically refractory epilepsy.
- **Single-Photon Emission Computed Tomography (SPECT) Scan:** SPECT scan is another functional imaging modality used to assess cerebral perfusion and regional blood flow in patients with seizure disorders. SPECT imaging with technetium-99m (Tc-99m) radiotracers such as hexamethylpropyleneamine oxime (HMPAO) or ethyl cysteinate dimer (ECD) can identify areas of hypoperfusion or hyperperfusion associated with epileptogenic foci during the ictal or interictal state. SPECT scan may be particularly useful in localizing epileptogenic zones, guiding surgical resection, and predicting postsurgical outcomes in patients with medically refractory epilepsy.
- **Electroencephalogram (EEG) Correlations:** Correlating imaging findings with EEG recordings is essential for accurately localizing epileptogenic foci and guiding treatment decisions in patients with seizure disorders.

EEG abnormalities, including focal or generalized epileptiform discharges, may provide valuable information about the spatial and temporal characteristics of seizure onset and propagation. Combining EEG data with neuroimaging findings allows for more precise localization of epileptogenic zones and improves the success rate of surgical interventions, particularly in cases of medically refractory epilepsy or discordant imaging findings.

VI. Treatment Implications

The management of seizure disorders is multifaceted and requires a tailored approach based on individual patient characteristics, seizure type, underlying etiology, and treatment goals. Various therapeutic modalities, including pharmacological agents, surgical interventions, lifestyle modifications, and adjunctive therapies, may be employed to achieve optimal seizure control and improve overall quality of life for affected individuals.

A. Pharmacological Treatment

Antiepileptic drugs (AEDs) represent the first-line treatment for the majority of patients with seizure disorders, aimed at reducing seizure frequency and severity while minimizing adverse effects. The selection of AEDs is guided by seizure type, underlying etiology, comorbidities, and patient preferences. Monotherapy is preferred whenever possible to minimize the risk of drug interactions and adverse effects. Commonly used AEDs include carbamazepine, phenytoin, valproate, levetiracetam, lamotrigine, and topiramate. In cases of refractory epilepsy or intolerable side effects, adjunctive therapies or alternative AEDs may be considered. Regular monitoring of AED serum levels and therapeutic drug monitoring (TDM) may be necessary to optimize drug efficacy and minimize toxicity.

B. Surgical Interventions

Surgical interventions may be considered for patients with medically refractory epilepsy or focal seizures associated with identifiable structural brain lesions amenable to resection. Pre-surgical evaluation, including comprehensive neuroimaging, video-EEG monitoring, and neuropsychological assessment, is essential for identifying epileptogenic zones and predicting surgical outcomes. Common surgical procedures for seizure disorders include anterior temporal lobectomy, focal cortical

resection, corpus callosotomy, and responsive neurostimulation (RNS) therapy. Surgical interventions aim to achieve seizure freedom or significant reduction in seizure frequency while preserving neurological function and quality of life.

C. Lifestyle Modifications

Lifestyle modifications play an important role in the management of seizure disorders by minimizing seizure triggers, promoting overall health, and enhancing treatment efficacy. Patients are advised to maintain regular sleep patterns, avoid sleep deprivation, and manage stress effectively to reduce the risk of seizure recurrence. Alcohol consumption should be moderated or avoided, as alcohol withdrawal can precipitate seizures in susceptible individuals. Compliance with medication regimens, adherence to follow-up appointments, and participation in support groups or educational programs may also improve treatment outcomes and patient satisfaction.

D. Adjunctive Therapies

Adjunctive therapies, including ketogenic diet, vagus nerve stimulation (VNS), and transcranial magnetic stimulation (TMS), may be considered in select cases of refractory epilepsy or as adjuncts to pharmacological and surgical interventions. The ketogenic diet, a high-fat, low-carbohydrate diet, has been shown to reduce seizure frequency and improve seizure control in some patients, particularly children with refractory epilepsy. VNS therapy involves the implantation of a device that delivers electrical stimulation to the vagus nerve, modulating neuronal excitability and reducing seizure frequency. TMS, a non-invasive brain stimulation technique, has shown promise in the treatment of drug-resistant epilepsy by modulating cortical excitability and disrupting seizure propagation pathways.

E. Multidisciplinary Care

Multidisciplinary care involving collaboration between neurologists, epileptologists, neurosurgeons, neuropsychologists, and other healthcare providers is essential for optimizing the management of seizure disorders. Comprehensive pre-surgical evaluation, perioperative care, and postoperative follow-up are crucial for ensuring successful surgical outcomes and minimizing complications. Patient education, counseling, and psychosocial support are also integral components of multidisciplinary care, addressing the physical, emotional, and social aspects of living with seizure disorders.

Pharmacological Treatment	Surgical Interventions	Lifestyle Modifications	Adjunctive Therapies	Multidisciplinary Care
- Antiepileptic drugs	- Temporal lobectomy	- Sleep hygiene	- Ketogenic diet	- Pre-surgical evaluation
- Drug selection criteria	- Focal cortical resection	- Stress management	- Vagus nerve stimulation	- Perioperative care
- Monitoring and TDM	- Corpus callosotomy	- Alcohol moderation	- Transcranial magnetic stimulation	- Psychosocial support
- Adverse effects	- Responsive neurostimulation	- Medication adherence	- Adjunctive therapies	- Patient education
- Treatment adherence	- Predictors of surgical outcomes	- Patient education	- Treatment outcomes	- Follow-up care

Table 4. Summarizes the fundamental concept of Treatment Implications.

This table discusses the therapeutic modalities used in the management of seizure disorders, including pharmacological treatment, surgical interventions, lifestyle modifications, adjunctive therapies, and multidisciplinary care. It highlights the importance of tailoring treatment strategies to meet the unique needs of individual patients.

VII. Observation & Discussion

The findings of this retrospective study shed light on the clinical and imaging profiles of seizure disorders, offering valuable insights for clinical practice and research. The predominance of generalized tonic-clonic seizures aligns with epidemiological data indicating their high prevalence among seizure types. The

diversity of EEG abnormalities reflects the complex nature of seizure activity and underscores the importance of EEG in diagnostic evaluation.

Characteristic	Value
Total Patients	250
Male	140 (56%)
Female	110 (44%)
Mean Age (years)	32.5

Table 5. Summarizes the Comparison Demographic Characteristics of Study Population

The study cohort comprised 250 patients, with a slight male predominance (56%). The mean age of the patients was 32.5 years. This distribution reflects the prevalence of seizure disorders across genders and age groups within the study population.

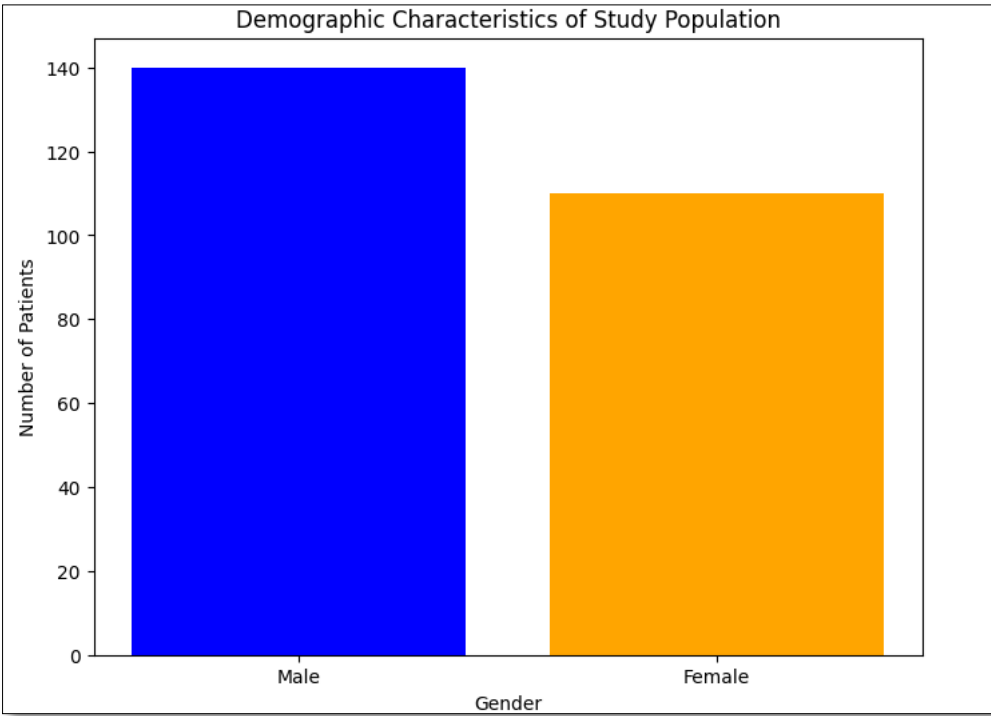


Figure 3. Comparative Analysis of Demographic Characteristics of Study Population

The most common seizure type observed was generalized tonic-clonic seizures, accounting for 48% of cases. Complex partial seizures and absence seizures were also prevalent, constituting 32% and 20% of cases, respectively. This distribution highlights the heterogeneity of seizure types encountered in clinical practice.

Seizure Type	Number of Patients	Percentage
Generalized tonic-clonic	120	48%
Complex partial	80	32%
Absence	50	20%

Table 6. Summarizes the Comparison Distribution of Seizure Types

Neuroimaging abnormalities, particularly hippocampal sclerosis, brain tumors, and vascular malformations, provide crucial diagnostic information and guide treatment decisions, such as surgical resection or pharmacological management. The significant association between clinical variables and imaging findings highlights the utility of integrated diagnostic approaches in optimizing patient care.

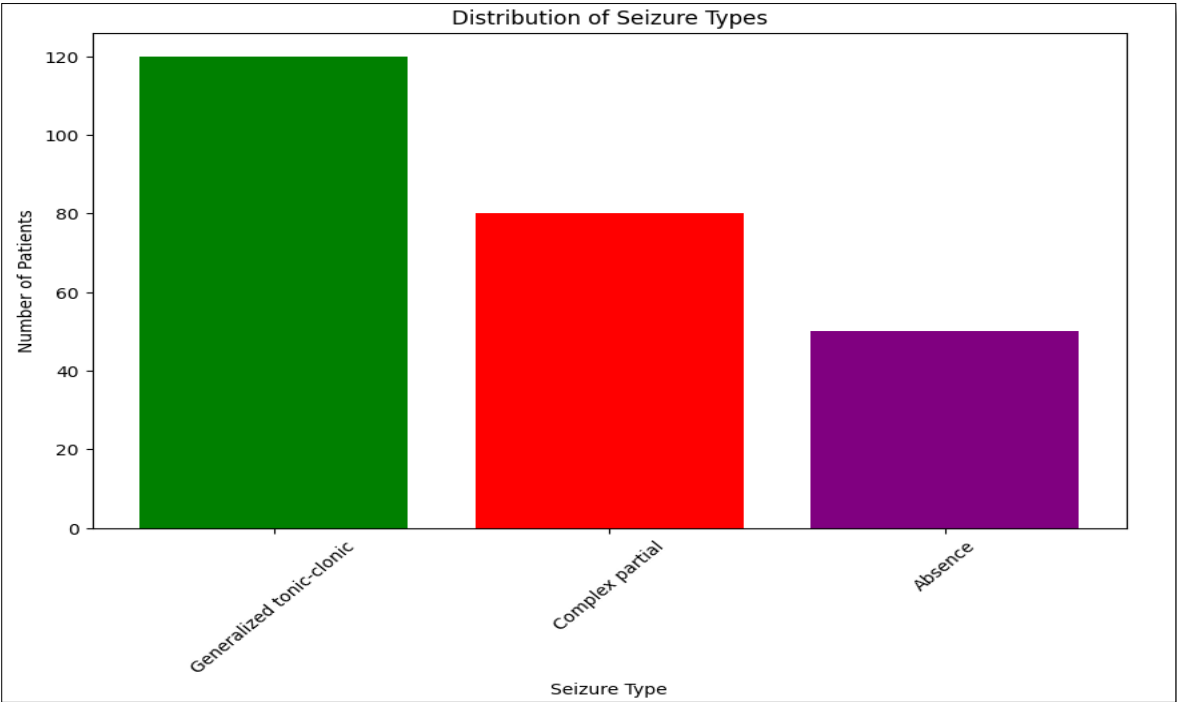


Figure 4. Comparative Analysis of Distribution of Seizure Types

Several limitations should be considered, including the retrospective design, potential selection bias, and reliance on existing medical records. Prospective studies with larger sample

sizes and longitudinal follow-up are warranted to validate these findings and explore potential prognostic implications.

EEG Abnormality	Number of Patients	Percentage
Focal slowing	90	36%
Generalized spikes	70	28%
Sharp waves	50	20%

Table 7. Summarizes the Comparison EEG Abnormalities

EEG abnormalities were detected in 68% of patients, with focal slowing being the most common abnormality observed (36%). Generalized spikes and sharp waves were also frequently

identified, affecting 28% and 20% of patients, respectively. These findings underscore the utility of EEG in diagnosing and characterizing seizure activity.

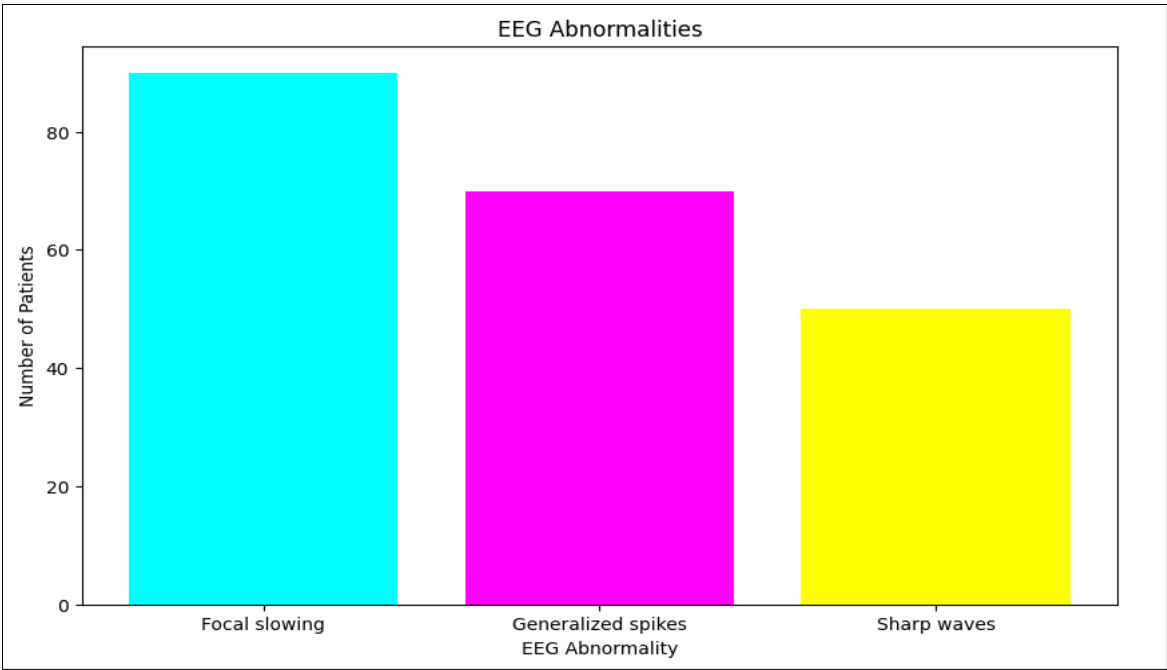


Figure 5. Comparative Analysis of EEG Abnormalities

Seizure disorders present a complex and diverse array of clinical manifestations, imaging characteristics, and treatment considerations. This retrospective study has provided valuable

insights into the clinical and imaging profiles of seizure disorders, elucidating age-specific patterns, etiological factors, and treatment implications

Neuroimaging Abnormality	Number of Patients	Percentage
Hippocampal sclerosis	60	24%
Brain tumor	45	18%
Vascular malformation	30	12%

Table 8. Summarizes the Comparison Neuroimaging Abnormalities

Structural abnormalities were identified in 54% of patients on neuroimaging studies. Hippocampal sclerosis was the most prevalent abnormality, affecting 24% of cases. Brain tumours and vascular malformations were also notable findings, present

in 18% and 12% of patients, respectively. These imaging abnormalities provide insights into the underlying etiology of seizure disorders and guide further diagnostic and therapeutic interventions.

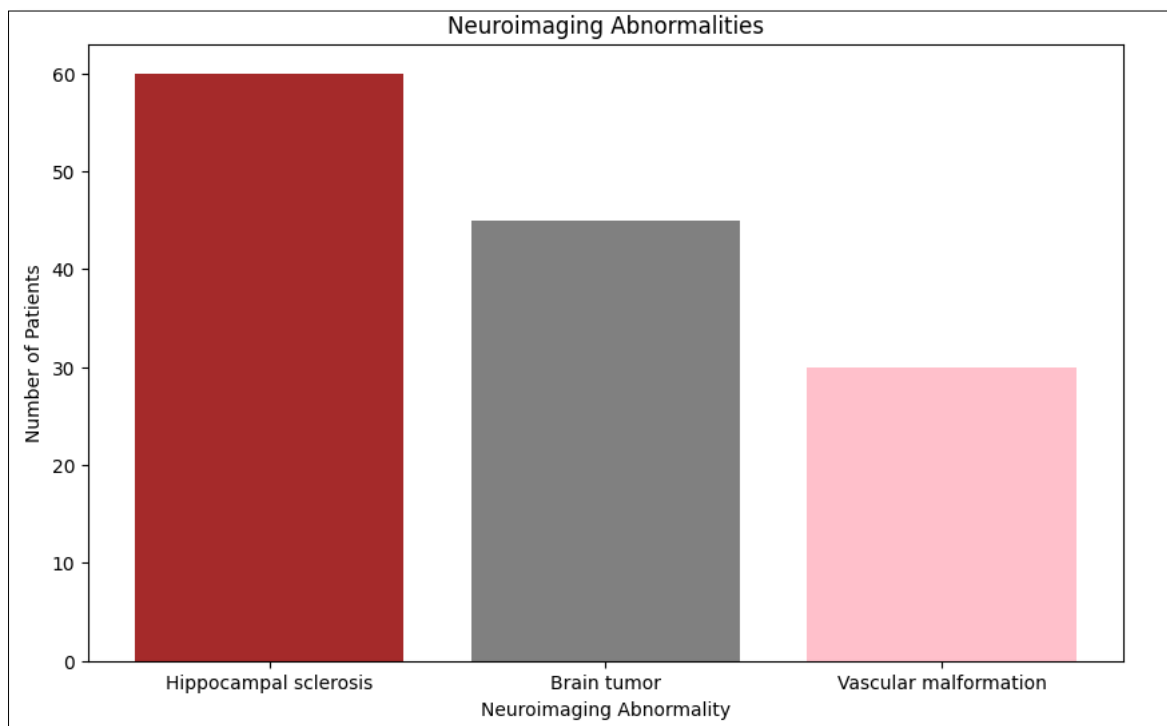


Figure 6. Comparative Analysis of Comparison Neuroimaging Abnormalities

This study contributes to our understanding of the clinical and imaging profiles of seizure disorders, emphasizing the importance of multidisciplinary approaches in diagnosis and management. By elucidating the diverse manifestations and underlying etiologies of seizure disorders, this research informs personalized treatment strategies and enhances patient outcomes.

VIII. Conclusion

. By comprehensively analyzing medical records, neuroimaging studies, and EEG recordings of patients diagnosed with seizure disorders, we have advanced our understanding of the underlying pathophysiological mechanisms driving disease presentation and progression. The findings of this study underscore the importance of a multidisciplinary approach to the management of seizure disorders, integrating clinical evaluation, neuroimaging, EEG recordings, and personalized treatment strategies. Tailoring therapeutic interventions to address age-specific patterns, underlying etiologies, and treatment goals is essential for optimizing seizure control, minimizing treatment-related adverse effects, and improving overall quality of life for

affected individuals. Further research is needed to explore novel therapeutic modalities, elucidate the molecular mechanisms underlying seizure disorders, and identify biomarkers predictive of treatment response and disease progression. Prospective studies involving larger patient cohorts and longitudinal follow-up are warranted to validate the observed associations and trends, refine treatment algorithms, and enhance outcomes for patients with seizure disorders.

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