A Study on Clinical and Electrophysiological Profile of Patients with Seizures / Epilepsy in a Tertiary Care Hospital

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Abstract: ***Background**: Epilepsy is a common neurological disorder affecting nearly 50 million people worldwide, with India accounting for about 12 million cases, almost one-sixth of the global burden. Accurate classification, aided by the ILAE 2017 framework, along with EEG and neuroimaging, is essential for diagnosis, prognostication, and management. **Aims and Objectives**: 1. To Study the Clinical Profile of Patients presenting with Seizures / Epilepsy. 2. To Study the Electrophysiological profile of Seizures / Epilepsy. 3. To Classify Seizures/Epilepsy according to ILAE Classification. **Materials and Methods**: A Hospital based Prospective observational study was conducted on 150 patients presenting with seizures/epilepsy to a tertiary care centre from September 2024 to December 2024.All patients aged above 5 years, presenting with Seizures / Epilepsy to Department of Neurology, Government General Hospital, Guntur were included in the study and Age < or equal to 5 years ,Pregnancy, Patients /guardian who have not given written consent were excluded .Clinical evaluation, seizure semiology, routine EEG, and neuroimaging were systematically recorded. Seizures were classified according to the ILAE 2017 classification. **Results**: The majority of patients were in the 20–40 years age group (42%), followed by 41–60 years (30%). Generalised seizures predominated (91.3%), with generalised tonic–clonic seizures (82%) being the most frequent subtype. Focal seizures accounted for 25.3%, mostly focal impaired awareness seizures (22%). Focal to bilateral tonic–clonic seizures were seen in 2%. Symptomatic/structural etiologies comprised 59.3%, with gliosis (27%), mesial temporal lobe sclerosis (12.4%), calcifications (12.4%), and cerebrovascular disease (11.4%) as leading causes. MRI revealed abnormalities in 66.7%, while EEG abnormalities were detected in 28%. **Conclusion**: This study highlights the predominance of generalised tonic–clonic seizures and a high burden of structural etiologies in a tertiary care cohort. Integration of clinical semiology, EEG, and neuroimaging is crucial for accurate classification and comprehensive epilepsy care in resource-limited settings.*

Keywords: Epilepsy; Seizure classifications; EEG; Neuroimaging; Structural Etiology

1. Introduction and Background

Epilepsy is one of the most common chronic neurological disorders worldwide, affecting over 50 million people and contributing significantly to global disability-adjusted life years (DALYs). The disorder is characterized by a persistent predisposition to generate epileptic seizures, with diverse clinical manifestations ranging from focal motor phenomena to generalized tonic–clonic seizures. The International League Against Epilepsy (ILAE) has refined seizure classification systems over the years, most recently in 2017, to better capture the spectrum of clinical and electrographic seizure types and to align terminology with modern diagnostic and therapeutic approaches.

ILAE 2017 Classification of Seizures

1) Focal Onset Seizures: Seizures originating in one hemisphere.

a) Awareness level
- Focal aware seizure (formerly “simple partial”) – awareness preserved.
- Focal impaired awareness seizure (formerly “complex partial”) – awareness impaired.

b) Motor onset
- Automatisms
- Atonic
- Clonic
- Epileptic spasms
- Hyperkinetic

- Myoclonic
- Tonic

c) *Non-motor onset*
- Autonomic
- Behavioral arrest
- Cognitive (e.g., déjà vu, hallucinations)
- Emotional (e.g., fear, joy)
- Sensory (e.g., visual, auditory, olfactory)

d) *Focal to bilateral tonic–clonic seizure*
- Seizure begins focally and evolves into bilateral tonic–clonic activity.

2) Generalised Onset Seizures: Seizures with bilateral hemispheric onset.

a) *Motor (convulsive)*
- Tonic–clonic
- Clonic
- Tonic
- Myoclonic
- Myoclonic–tonic–clonic
- Myoclonic–atonic
- Atonic
- Epileptic spasms

b) *Non-motor (absence seizures)*
- Typical absence
- Atypical absence
- Myoclonic absence
- Eyelid myoclonia

3) Unknown Onset Seizures: When onset is not witnessed or unclear.
- Motor: tonic–clonic, epileptic spasms
- Non-motor: behavior arrest

In developing countries, including India, epilepsy carries a disproportionate burden due to higher incidence of structural and symptomatic causes such as perinatal insults, neuroinfectious, head injury, stroke, and autoimmune in addition to idiopathic and genetic forms of epilepsy. Despite being a treatable disorder in nearly 70% of patients, a substantial treatment gap persists, largely driven by limited diagnostic facilities, stigma, and under-recognition of non-convulsive and focal epilepsies.

Electroencephalography (EEG) remains a cornerstone in the evaluation of seizures, offering not only diagnostic support but also insights into seizure semiology, classification, and prognostication. The integration of clinical semiology with electrophysiological findings is critical for accurate diagnosis, rational antiepileptic drug (AED) selection, and surgical candidacy evaluation in refractory cases. Similarly, neuroimaging complements clinical and EEG findings by delineating structural substrates such as mesial temporal sclerosis, gliotic scars, vascular insults, and developmental malformations.

Several Indian studies have addressed epidemiology and clinical aspects of epilepsy; however, there remains a need for comprehensive profiling that combines clinical, imaging, and electrophysiological characteristics in a tertiary care context. Such data are vital for guiding early diagnosis, improving classification accuracy, and informing tailored treatment strategies in resource-limited settings.

Aims and Objectives
1) To Study the Clinical Profile of Patients presenting with Seizures / Epilepsy.
2) To Study the Electrophysiological profile of Seizures / Epilepsy.
3) To Classify Seizures/Epilepsy according to ILAE Classification

2. Materials and Methods

Study design: Hospital based Prospective observational study

Duration of the study: September 2024 to December 2024

Sample size: 150

Source of the data: All patients aged above 5 years, presenting with Seizures / Epilepsy to Department of Neurology, Government General Hospital, Guntur

Inclusion Criteria: The patients aged above 5 years presenting to Department of Neurology with Seizures /Epilepsy.

Exclusion Criteria: Age < or equal to 5 years.
Pregnancy
Patients /guardian who have not given written consent

Table 1: Age distribution

Age	No of cases =150
<20 years	32 (21.3%)
20 - 40 years	63 (42%)
41 - 60 years	45 (30%)
61- 80 years	8 (5.3%)
81 -100 years	2 (1.3%)

Age Distribution: In this study comprising 150 patients with seizures, the age-wise distribution showed that the majority of cases (42%) were in the 20–40 years age group (n=63). The 41–60 years group contributed to 30% of cases (n=45), while patients below 20 years accounted for 21.3% (n=32). The 61–80 years group represented only 5.3% (n=8), and a very small proportion of patients were in the 81–100 years group (1.3%, n=2)

Table 2: Gender Distribution

Gender	No of cases n=150
Male	80 (53.3%)
Female	70 (46.6%)

Gender Distribution: Out of 150 patients studied, 80 were males (53.3%) and 70 were females (46.6%), showing a slight male predominance. This indicates that although both sexes were almost equally affected, seizures were marginally more common among males in this cohort.

Table 3: Seizure Classification According to ILAE 2017

ILAE Category	Subtype	No. of cases
`	Focal aware seizures Focal impaired awareness seizures Total focal seizures	5 (3.3%) 33 (22%) 38 (25.3%)
Focal to Bilateral Tonic–Clonic		3 (2%)
Generalised Onset Seizures	Tonic Tonic–clonic Myoclonic Absence Total generalized seizures	5 (3.3%) 123 (82%) 3 (2%) 6 (4%) 137 (91.3%)
Multiple seizure types		11 (7.3%)
Unknown / Unclassified	PNES (non-epileptic)	4 (2.7%)

Seizure Classification According to ILAE 2017: Among the 150 patients, generalized seizures were the predominant type, observed in 137 cases (91.3%). Within this category, generalized tonic–clonic seizures (GTCS) were the most frequent, comprising 123 cases (82%), tonic seizures in 5 cases (3.3%), absence seizures in 6 cases (4%), and myoclonic seizures in 6 cases (2%). Partial seizures were reported in 38 cases (25.3%). Of these, 5 patients (3.3%) had focal seizures without impaired awareness, while 33 patients (22%) experienced focal seizures with impaired awareness.

Additionally, secondary generalized seizures were documented in 3 patients (2%), multiple seizure types in 11 patients (7.3%), and psychogenic non-epileptic seizures (PNES) in 4 patients (2.7%).

Table 4: Diagnostic Categorization:

Diagnosis	No of cases (n=150)
Idiopathic Generalised Epilepsy	54 (36%)
Symptomatic seizures	89 (59.3%)
PNES	4 (2.7%)
Epileptic encephalopathy	2 (1.3%)
Juvenile myoclonic epilepsy	1 (0.7%)

Diagnostic Categorization: Based on diagnostic categorization, the majority of cases were symptomatic seizures, observed in 89 patients (59.3%). Idiopathic generalized epilepsy accounted for 54 cases (36%), while smaller proportions were seen with psychogenic non-epileptic seizures (PNES) in 4 patients (2.7%), epileptic encephalopathy in 2 patients (1.3%), and juvenile myoclonic epilepsy in 1 patient (0.7%).

Table 5: Symptomatic seizures

Symptomatic seizures	No of cases (n=89)
Gliosis	24 (27%)
Mesial temporal lobe sclerosis	11 (12.4%)
Hypoxic ischemic sequelae	7 (7.9%)
calcification	11 (12.4%)
CSVT	2 (2.2%)
CVA: Infarct: Hemorrhage:	10 (11.4%) 6 (6.8%) 4 (4.5%)
Alcohol	5 (5.6%)
Autoimmune encephalitis	6 (6.7%)
Post encephalitis sequelae	3 (3.4%)
Ischemic	4 (4.5%)
Focal cortical dysplasia	1 (1.1%)
Leukodystrophy	1 (1.1%)
Cyst	1 (1.1%)
Hydrocephalus	1 (1.1%)
Hypoglycemia and Hyperglycemia	2 (2.2%)

Symptomatic Seizures: Among the 89 patients with symptomatic seizures, the most common etiology was gliosis, seen in 24 cases (27%). This was followed by mesial temporal lobe sclerosis (MTLS) and calcifications, each contributing 11 cases (12.4%). Cerebrovascular accidents (CVA) were identified in 10 patients (11.4%), including 6 cases of infarct (6.8%) and 4 cases of hemorrhage (4.5%).

Other notable causes included hypoxic–ischemic sequelae (7.9%, n=7), autoimmune encephalitis (6.7%, n=6), and alcohol-related seizures (5.6%, n=5). Less frequent etiologies comprised post-encephalitic sequelae (3.4%, n=3), ischemic lesions (4.5%, n=4), and cerebral venous sinus thrombosis (CVST, 2.2%, n=2). Rare causes such as focal cortical dysplasia, leukodystrophy, cyst, and hydrocephalus were each observed in 1 patient (1.1%). Additionally, metabolic abnormalities (hypoglycemia/hyperglycemia) accounted for 2 cases (2.2%).

Table 6: Imaging changes

MRI Brain Epilepsy protocol	No of cases (n=150)
Normal	50 (33.3%)
Abnormal	100 (66.7%)
Abnormal MRI Brain	No of cases
Gliosis	24 (24%)
MTLS	11 (11%)
Hypoxic ischemic sequelae	7 (7%)
Calcification	11 (11%)
CVA	10 (10%)
Leukodystrophy	1 (1%)
Autoimmune	6 (6%)
Post encephalitis sequelae	3 (3%)

CSVT	2 (2%)
Focal cortical dysplasia	1 (1%)
Cerebral atrophy	6 (6%)
Postictal changes	2 (2%)
Ischemic	4 (4%)
Chronic infarct	5 (5%)
Hydrocephalus	1 (1%)
Nonspecific changes	5 (5%)
Cyst	1 (1%)

Magnetic resonance imaging (MRI) of the brain: MRI was performed in all patients. Out of 150 cases, 100 patients (66.7%) showed abnormal findings, while 50 patients (33.3%) had normal MRI scans. Among the 100 patients with abnormal MRI scans, the most frequent abnormality was gliosis, observed in 24 cases (24%). Other common findings included mesial temporal lobe sclerosis (MTLS) and parenchymal calcifications (11% each), and cerebrovascular accidents (CVA) in 10 cases (10%). Less frequent abnormalities comprised hypoxic–ischemic sequelae (7%), autoimmune lesions (6%), cerebral atrophy (6%), chronic infarcts (5%), and non-specific changes (5%). Ischemic lesions (4%), post-encephalitic sequelae (3%), cerebral venous sinus thrombosis (CVST, 2%), and postictal changes (2%) were also identified. Rare abnormalities included focal cortical dysplasia (1%), leukodystrophy (1%), hydrocephalus (1%), and cystic lesions (1%).

Table 7: EEG Changes

EEG	No of cases (n =150)
Normal	108 (72%)
Abnormal	42 (28%)

Electroencephalography (EEG) : EEG was performed in all patients. Of the 150 cases, 108 patients (72%) showed normal EEG recordings, while 42 patients (28%) demonstrated abnormal findings.

Table 8: Psychiatric illness

Psychiatric illness	No of cases (n=150)
Yes	29 (19.3%)
No	121 (80.6%)

Psychiatric illness: Out of 150 patients, 29 (19.3%) had a coexisting psychiatric illness, while 121 patients (80.6%) did not report any psychiatric comorbidity.

Table 9: Management

Management	No of cases (n=150)
Monotherapy	57 (38%)
Polytherapy	93 (62%)

Management: Among the 150 patients, 57 (38%) were managed with monotherapy, while 93 patients (62%) required polytherapy for seizure control.

3. Results

A total of 150 patients with seizures were included in this study. The age distribution showed that the majority of cases occurred in the 20–40 years group (42%, n=63), followed by the 41–60 years group (30%, n=45). Patients aged <20 years accounted for 21.3% (n=32), while those in the 61–80 years group contributed 5.3% (n=8). Only 2 patients (1.3%) were aged above 80 years. This demonstrates that seizures were most frequent among young and middle-aged adults, with relatively fewer cases at the extremes of age. With respect to gender distribution, 80 patients were male (53.3%) and 70 were female (46.6%), indicating a slight male predominance, generalized seizures were the predominant type, observed in 137 patients (91.3%). Among these, generalized tonic–clonic seizures (GTCS) constituted the largest subgroup (82%, n=123), followed by tonic seizures (4%, n=6), absence seizures (4%, n=6), and myoclonic seizures (2%, n=3). Partial seizures were identified in 38 patients (25.3%), with focal seizures without impaired awareness in 5 cases (3.3%), and focal seizures with impaired awareness in 33 cases (22%). In addition, secondary generalized seizures were documented in 3 patients (2%), multiple seizure types in 11 patients (7.3%), and psychogenic non-epileptic seizures (PNES) in 4 patients (2.7%). The majority of cases were diagnosed as symptomatic seizures (59.3%, n=89). Idiopathic generalized epilepsy accounted for 54 patients (36%), while PNES was identified in 4 cases (2.7%). Less frequent categories included epileptic encephalopathy (1.3%, n=2) and juvenile myoclonic epilepsy (0.7%, n=1). Among the 89 symptomatic cases, the most common etiology was gliosis (27%, n=24). Other important causes included mesial temporal lobe sclerosis (12.4%, n=11), calcifications (12.4%, n=11), and cerebrovascular accidents (11.4%, n=10), of which 6 were infarcts (6.8%) and 4 hemorrhages (4.5%).Additional etiologies included hypoxic–ischemic sequelae (7.9%, n=7), autoimmune encephalitis (6.7%, n=6), alcohol-related seizures (5.6%, n=5), ischemic lesions (4.5%, n=4), and post-encephalitic sequelae (3.4%, n=3). Rare causes such as CVST (2.2%, n=2), focal cortical dysplasia (1.1%, n=1), leukodystrophy (1.1%, n=1), cyst (1.1%, n=1), and hydrocephalus (1.1%, n=1) were also identified. Metabolic abnormalities (hypoglycemia/ hyperglycemia) were seen in 2 patients (2.2%).

MRI of the brain was abnormal in 100 patients (66.7%), while 50 patients (33.3%) had normal scans. Among the abnormal MRIs, the most frequent finding was gliosis (24%), followed by MTLS (11%), calcifications (11%), and CVA (10%). Other abnormalities included hypoxic–ischemic sequelae (7%), autoimmune lesions (6%), cerebral atrophy (6%), chronic infarcts (5%), non-specific changes (5%), and ischemic lesions (4%). Less frequent findings were post-encephalitic sequelae (3%), CVST (2%), postictal changes (2%), focal cortical dysplasia (1%), leukodystrophy (1%), hydrocephalus (1%), and cystic lesions (1%).

EEG was normal in 108 patients (72%) and abnormal in 42 patients (28%). The relatively high proportion of normal EEGs reflects the limitations of interictal recordings in capturing epileptiform discharges, though abnormal EEGs provided important diagnostic and localization value. A total of 29 patients (19.3%) had coexisting psychiatric illness, while 121 patients (80.6%) did not report psychiatric comorbidities. Psychiatric disorders, particularly depression and subnormal IQ were frequently observed, emphasizing the

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need for integrated neuropsychiatric evaluation. Regarding management, 57 patients (38%) were on monotherapy, whereas 93 patients (62%) required polytherapy with two or more antiepileptic drugs. The predominance of polytherapy suggests a high burden of drug-resistant epilepsy in this cohort, consistent with the referral nature of a tertiary care center.

4. Discussion

In this tertiary-care cohort (n=150), seizures clustered in young and middle-aged adults, with 72% between 20–60 years and a smaller pediatric and elderly contribution. This age distribution is consistent with Indian epidemiology, where the median age at onset is around 20 years and a sizeable burden falls on productive age groups in low- and middle-income settings. The national burden is substantial—approximately 12 million people in India live with epilepsy (≈1% prevalence)—and service planning must account for this younger demographic profile [1].

Generalised seizures predominated (91.3%), with generalized tonic–clonic seizures (GTCS) comprising 82% of all cases. Several Indian series also report a dominance of generalised seizures, though at lower proportions (~59–73%), with focal epilepsies comprising a larger share than observed here. Joseph et al. from Kerala reported 58.8% generalised vs 30.6% focal, while Mehndiratta et al. found 69% generalised vs 15% focal in a multicenter Indian clinic cohort [2,3]. The higher GTCS proportion in our study may reflect referral bias to emergency/acute services, under-recognition of non-convulsive/focal phenotypes, and reliance on single routine EEGs. Classification was applied according to ILAE 2017, which improves clarity around onset (focal, generalised, unknown) and formally recognises focal to bilateral tonic–clonic evolution [4–6].

Most patients were symptomatic/structural (59.3%), consistent with LMIC patterns where perinatal injury, infections, trauma, and cerebrovascular disease contribute heavily [1]. On MRI, abnormalities were present in 66.7%, comparable to mixed-age cohorts where 50–70% abnormal yields are typical when imaging is systematically obtained. Within the abnormal group (n=100), gliosis (24%) and mesial temporal lobe sclerosis (MTLS, 11%) were common findings aligned with Indian and global literature that identify hippocampal sclerosis and gliotic scars as major substrates of focal epilepsy [7,8]. Calcifications (11%) and CVA-related lesions (10%) also figured prominently, paralleling Indian reports where neurocysticercosis, tuberculomas, post-ischemic scars, and malformations are recurrent causes [9]. Less frequent but notable findings included CSVT (2%), post-encephalitic sequelae (3.4%), and autoimmune encephalitis (6.7%), reflecting emerging recognition of immune-mediated epilepsies in tertiary cohorts.

The EEG yield (abnormal in 28%) was lower than practice-based estimates, where ~53% show epileptiform abnormalities on the first routine EEG, increasing to ~72% by the third [10]. Yield rises further with sleep-deprivation, serial recordings, and prolonged monitoring. The comparatively low yield here likely reflects timing (interictal recordings distant from seizures), antiseizure drug exposure, and limited use of activation procedures—factors well-documented to depress interictal epileptiform discharge detection [11,12].

5. Conclusion

Seizures in this cohort were most frequent among young and middle-aged adults, with a slight male predominance. Generalized tonic–clonic seizures were the commonest presentation, and symptomatic etiologies, particularly gliosis, mesial temporal sclerosis, and vascular lesions, formed the majority. The high prevalence of abnormal MRI findings and the need for polytherapy in most patients highlight the significant burden of structural and drug-resistant epilepsy in a tertiary care setting, underscoring the importance of early diagnosis, comprehensive evaluation, and individualized management. Compared with other Indian studies, this cohort shows a higher share of GTCS but a similar spectrum of structural etiologies (gliosis, MTLS, calcifications, CVA). Aligning diagnostic workflows with ILAE guidance and improving access to EEG/MRI should enhance classification accuracy, guide treatment, and identify surgical candidates.

6. Limitations of the Study

This study is subject to few limitations.
1) The sample size was relatively small (n=150) and derived from a single tertiary-care Centre, which may limit the generalizability of findings to the broader community.
2) Patients with traumatic brain injury–related seizures and pediatric-onset epilepsy were excluded, restricting the spectrum of etiologies represented and underestimating the burden of symptomatic and developmental epilepsies.
3) Neuropsychological and psychiatric comorbidities—important determinants of quality of life—were not systematically evaluated

Confirm that approval has been obtained from Institutional Ethics committee, Guntur Medical College, Guntur, AP, India.

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