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CLASSIFICATION OF EPILEPSY: A COMPREHENSIVE NARRATIVE REVIEW

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Abstract

Epilepsy represents one of the most prevalent neurological disorders globally, affecting approximately 50 million people worldwide. The classification of epilepsy and seizure types has undergone significant transformation over the past century, evolving from simple descriptive categories to sophisticated, multidimensional frameworks based on neurophysiological mechanisms. This narrative review examines the current International League Against Epilepsy (ILAE) 2017 classification system, its historical evolution, and the newly updated 2025 revisions. We explore the three-tiered diagnostic approach encompassing seizure types, epilepsy types, and epilepsy syndromes, while integrating etiological considerations throughout each level. Understanding these classification systems is essential for accurate diagnosis, appropriate treatment selection, and prognostic assessment in clinical practice.

Keywords: Epilepsy classification, ILAE 2017, seizure types, focal seizures, generalized seizures, epilepsy syndromes, operational classification

Introduction

Epilepsy is defined as a disorder of the brain characterized by an enduring predisposition to generate epileptic seizures and by the neurobiological, cognitive, psychological, and social consequences of this condition . The classification of epilepsy has presented a persistent challenge to neurologists since ancient times, when seizures were attributed to supernatural causes rather than neurological dysfunction.

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Modern classification systems emerged in the mid-20th century, driven by advances in electroencephalography (EEG) and neuroimaging technologies that revealed the heterogeneous nature of seizure disorders.

The fundamental importance of accurate classification extends beyond academic categorization. Proper classification directly influences treatment decisions, prognostic counseling, and research design. As Fisher et al. (2017) emphasized, "The classification allows new types of focal seizures and a few new generalized seizures, and clarifies terms used to name seizures" . The ILAE 2017 classification represents the most significant revision in decades, replacing terminology that had become outdated while maintaining clinical utility.

Historical Evolution of Epilepsy Classification

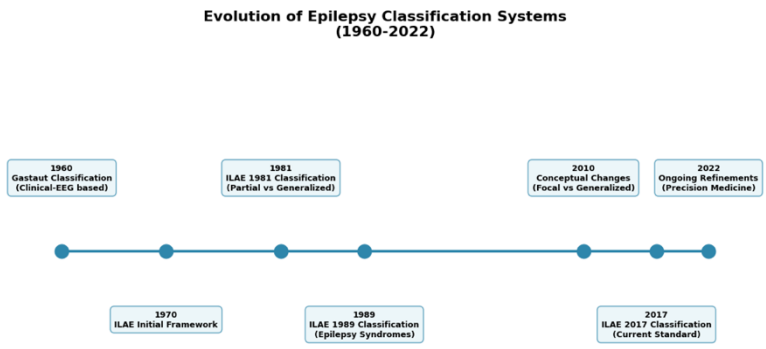

Figure 1. Timeline showing the evolution of epilepsy classification systems from 1960 to 2022. The progression reflects increasing understanding of seizure neurophysiology and the need for standardized terminology in clinical practice and research.

The journey toward modern epilepsy classification began with Henri Gastaut's pioneering work in the 1960s, which established the foundation for clinical-EEG correlation . The ILAE subsequently developed formal classification systems in 1970, with major revisions in 1981 and 1989 that became the international standards for decades. The 1981 classification distinguished between "partial" (focal) and generalized seizures, while the 1989 system added epilepsy syndromes as a third diagnostic level.

However, by the early 21st century, several limitations became apparent. The term "partial" was considered potentially pejorative and anatomically imprecise. The distinction between "simple partial" and "complex partial" seizures based on

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consciousness alone failed to capture the full clinical spectrum. Additionally, the classification did not adequately incorporate modern understanding of seizure networks, genetic etiologies, or the bidirectional relationship between focal and generalized seizure activity.

The ILAE initiated a comprehensive revision process in 2010, culminating in the 2017 operational classification . This system was further refined in 2025, incorporating clinical implementation experience and addressing identified weaknesses . The 2025 update maintains four main seizure classes—Focal, Generalized, Unknown, and Unclassified—while introducing important conceptual changes including the replacement of "awareness" with "consciousness" as a classifier .

The Three-Tiered Classification Framework

The current ILAE classification operates across three distinct levels: (1) seizure type, (2) epilepsy type, and (3) epilepsy syndrome. Each level provides increasingly specific diagnostic information while incorporating etiological considerations throughout .

Level One: Seizure Type Classification

The first and most fundamental level addresses the question: "What happens during the seizure?" This operational classification relies on observable semiological features rather than underlying pathophysiology, making it applicable even when full diagnostic workup is unavailable.

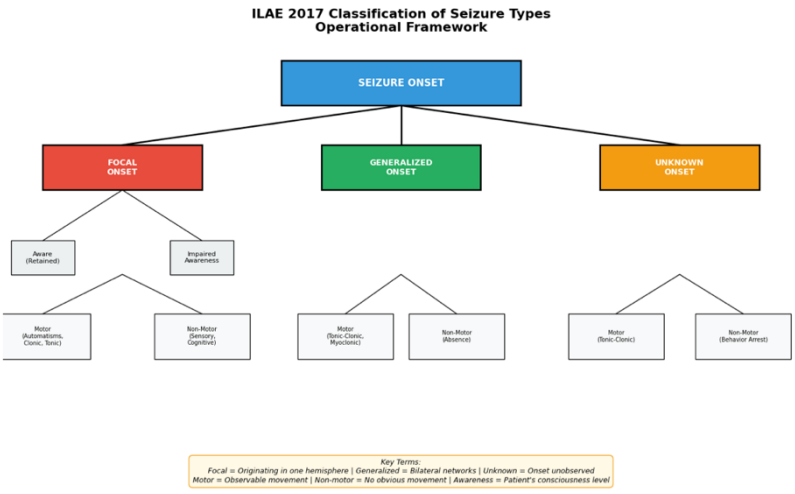

Figure 2. ILAE 2017 Expanded Classification of Seizure Types infographic showing the three main onset categories (Focal, Generalized, Unknown) with their motor and

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non-motor subtypes. This visual framework assists clinicians in applying the classification system at the bedside. Source: International League Against Epilepsy .

Focal Onset Seizures

Focal seizures originate within networks limited to one hemisphere, though they may spread to involve bilateral structures . The 2017 classification introduced crucial distinctions based on awareness level:

Focal Aware Seizures (formerly "simple partial"): These seizures do not cause loss of awareness. The patient remains conscious of self and environment throughout the event, even if immobile . Clinical manifestations may include sensory disturbances (paresthesias, visual or auditory hallucinations), motor phenomena (clonic, tonic, or myoclonic activity), autonomic symptoms, or psychic experiences such as déjà vu. Because awareness is preserved, patients can often provide detailed accounts of their experiences, making these seizures valuable for localizing the epileptogenic zone.

Focal Impaired Awareness Seizures (formerly "complex partial"): These involve impairment of consciousness at any point during the seizure . The impairment may be subtle, involving only diminished responsiveness, or profound, with complete unresponsiveness. These seizures frequently feature automatisms—repetitive, quasi-purposeful behaviors such as lip-smacking, hand-wringing, or fumbling with clothing. Postictal confusion typically lasts minutes to hours, distinguishing these from absence seizures.

The anatomical distribution of focal impaired awareness seizures reveals important patterns. Approximately 60-70% originate in the temporal lobe, particularly mesial temporal structures including the hippocampus and amygdala . The characteristic semiology of mesial temporal seizures includes epigastric auras (rising sensations), olfactory hallucinations, and oroalimentary automatisms. Extratemporal origins account for 10-30% of cases, with frontal lobe seizures often presenting with hypermotor activity, asymmetric tonic posturing, or bizarre vocalizations .

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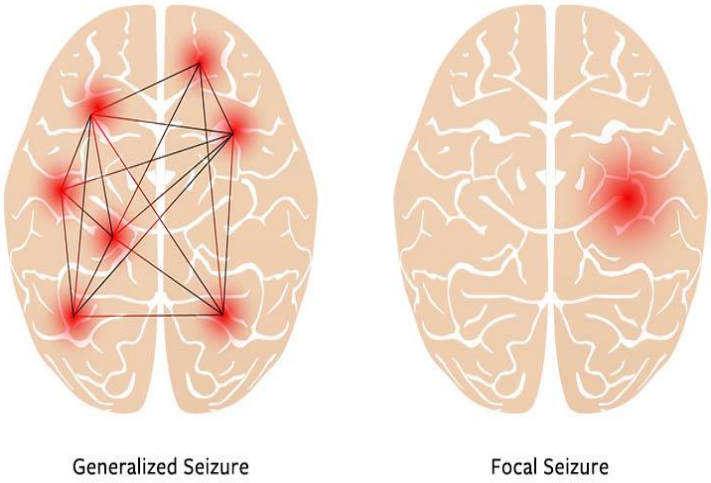

Figure 3. Comparative illustration of generalized versus focal seizure activity. Generalized seizures involve bilateral synchronous electrical discharge across both hemispheres, while focal seizures originate from a discrete cortical focus with variable propagation patterns. Source: NIH MedlinePlus Magazine.

Generalized Onset Seizures

Generalized seizures engage bilateral networks from onset, though the exact anatomical substrate remains debated. The 2017 classification recognizes two main categories:

Generalized Motor Seizures: These include tonic-clonic (formerly "grand mal"), clonic, tonic, myoclonic, and atonic variants. Tonic-clonic seizures represent the most dramatic presentation, featuring loss of consciousness, tonic extension followed by clonic jerking, and postictal confusion. Myoclonic seizures involve brief, shock-like muscle contractions that may be isolated or recurrent. Atonic seizures (drop attacks) cause sudden loss of postural tone with falls, posing significant injury risk.

Generalized Non-Motor (Absence) Seizures: These are characterized by abrupt onset and offset of impaired consciousness without motor manifestations, though subtle automatisms may occur . Typical absence seizures last 5-15 seconds, occur dozens to hundreds of times daily, and demonstrate characteristic 3 Hz spike-and-wave patterns on EEG. Atypical absences show more gradual onset/offset, longer duration, and less regular EEG patterns.

Unknown Onset Seizures

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This category acknowledges clinical reality: seizure onset is not always observed, particularly for nocturnal seizures or those occurring without witnesses. Unknown onset seizures may still be classified as motor or non-motor based on observable features, with "unclassified" reserved for seizures defying categorization due to insufficient information .

Level Two: Epilepsy Type

Once seizure types are identified, the classification proceeds to epilepsy type, which considers the broader pattern of seizure activity:

- Focal Epilepsy: Seizures consistently arise from one hemisphere
- Generalized Epilepsy: Seizures engage bilateral networks from onset
- Combined Generalized and Focal Epilepsy: Both seizure types occur (e.g., Dravet syndrome)
- Unknown Epilepsy: Classification unclear despite diagnostic workup

Level Three: Epilepsy Syndromes

Epilepsy syndromes represent specific diagnostic entities characterized by clusters of clinical features, EEG patterns, etiologies, and prognostic implications . Syndrome diagnosis carries significant treatment implications—some syndromes respond to specific medications while others may worsen with inappropriate drug selection. Examples include:

Childhood Absence Epilepsy: Onset 4-10 years, typical absence seizures, excellent response to ethosuximide or valproate

Juvenile Myoclonic Epilepsy: Adolescent onset, morning myoclonus, generalized tonic-clonic seizures, lifelong treatment typically required

Dravet Syndrome: Severe infantile onset, fever-sensitive seizures, SCN1A mutations, treatment-resistant

Lennox-Gastaut Syndrome: Triad of multiple seizure types (including tonic), slow spike-wave EEG, cognitive impairment

Etiological Integration

A revolutionary aspect of the 2017 classification is the mandatory consideration of etiology at every diagnostic level. The classification recognizes six etiological categories:

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Structural: Identifiable brain abnormalities (stroke, trauma, tumor, malformation)

Genetic: Monogenic mutations or complex inheritance patterns

Infectious: Neurocysticercosis, tuberculosis, HIV, encephalitis

Metabolic: Inborn errors of metabolism, mitochondrial disorders

Immune: Autoimmune encephalitis, antibody-mediated syndromes

Unknown: No identifiable cause despite thorough investigation

This etiological framework recognizes that epilepsy is not a single disease but a collection of disorders with diverse mechanisms requiring individualized approaches .

The 2025 Classification Updates

In 2025, the ILAE released updated operational classification guidelines based on extensive clinical implementation experience . Six key changes were introduced:

Removal of "Onset" from class names: The terms "Focal Onset," "Generalized Onset," and "Unknown Onset" were simplified to "Focal," "Generalized," and "Unknown"

Distinction between classifiers and descriptors: Classifiers reflect biological categories affecting management; descriptors characterize specific features

Consciousness replaces awareness: Consciousness is operationally defined by both awareness and responsiveness, providing more objective assessment criteria

Observable vs. non-observable manifestations: Replaces the motor/non-motor dichotomy, better capturing the clinical reality of seizure semiology

Chronological sequence description: Seizures are described by the sequence of signs/symptoms rather than relying solely on the first manifestation

Recognition of epileptic negative myoclonus: A newly recognized seizure type

The 2025 classification comprises 21 seizure types compared to 63 in the 2017 version, streamlining clinical application while maintaining diagnostic precision .

Clinical Application and Practical Considerations

Successful implementation of the classification system requires attention to several practical considerations:

Documentation of Awareness: Determining awareness requires direct observation or careful history-taking. The 2017 classification defines awareness as "the patient's

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knowledge of self and environment" . Impaired awareness at any point during a focal seizure renders it a focal impaired awareness seizure, even if awareness was initially preserved.

Seizure Evolution: Many focal seizures evolve through multiple phases. The classification prioritizes the earliest prominent manifestation for categorization, though the 2025 update allows for sequential description . For example, a seizure beginning with déjà vu (cognitive), progressing to staring and automatisms (impaired awareness), and culminating in tonic-clonic activity would be classified as focal impaired awareness with evolution to bilateral tonic-clonic.

Video-EEG Correlation: The gold standard for seizure classification remains video-EEG monitoring, allowing precise correlation of behavioral semiology with electrographic patterns. However, the operational classification is designed for application even when EEG is unavailable.

Implications for Treatment and Prognosis

Classification directly influences therapeutic decisions. Focal seizures generally respond to antiseizure medications effective against focal activity (carbamazepine, levetiracetam, lacosamide), while generalized seizures require broad-spectrum agents (valproate, lamotrigine, topiramate) . Critically, some medications effective for focal seizures (carbamazepine, oxcarbazepine) may exacerbate certain generalized epilepsy syndromes.

Surgical candidacy depends entirely on accurate classification. Patients with drug-resistant focal epilepsy may be candidates for resective surgery, while generalized epilepsies require alternative approaches such as neuromodulation or dietary therapy.

Prognostic information also derives from classification. Focal impaired awareness seizures have higher recurrence risk than focal aware seizures, and certain epilepsy syndromes carry specific prognostic implications regarding developmental outcomes, treatment resistance, and mortality risk .

Future Directions

The classification of epilepsy continues evolving with technological advances. Several emerging trends will likely influence future revisions:

Precision Medicine Integration: Genetic testing increasingly identifies specific mutations with treatment implications. The classification will likely expand to incorporate molecular diagnostic categories alongside clinical phenotypes.

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Neuroimaging Biomarkers: Advanced MRI techniques including functional connectivity mapping and machine learning-based lesion detection may enable more precise localization and network characterization.

Artificial Intelligence: Automated seizure detection and classification algorithms using wearable devices and implanted systems may provide objective, continuous classification data.

Network Neuroscience: Understanding seizures as network phenomena rather than focal events may necessitate new classification dimensions addressing network topology and dynamics.

Conclusion

The classification of epilepsy has transformed from descriptive categorization to a sophisticated, multidimensional framework integrating semiology, anatomy, etiology, and prognosis. The ILAE 2017 classification and its 2025 update provide operational tools applicable across diverse clinical settings, from resource-limited environments to advanced epilepsy centers. Accurate classification remains fundamental to appropriate treatment selection, prognostic counseling, and meaningful research.

As our understanding of seizure networks, genetic mechanisms, and therapeutic targets expands, the classification system will undoubtedly continue evolving. However, the core principle—systematic categorization based on observable clinical features—will remain essential for effective epilepsy care worldwide.

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