

## Classification of seizures

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Classification schemes can appear dull and cumbersome, but are crucial to facilitate diagnosis of epilepsy, communication between health professionals, and communication between professionals and people with epilepsy. Because there is not a one-to-one mapping between underlying disease and clinical phenomenology in the epilepsies, there is a need for at least two separate classification schemes: a classification of *seizures* (i.e. a scheme based on clinically observable phenomenology) and a classification of *epilepsies* (i.e. a scheme based on underlying aetiology). Even more ambitiously, the International League against Epilepsy (ILAE) has recently proposed a set of classification schemes based on five axes: ictal phenomenology, seizure type, syndrome, aetiology, and impairment. However, this approach has not yet achieved consensus approval.

A major contribution of the ILAE was the establishment of standardised classifications and terminology for epileptic seizures in 1981<sup>1</sup>, summarised in Table I. However, a great deal has changed in the ensuing quarter of a century, and the ILAE has recognised a pressing need for a new scheme. This new scheme is a 'work in progress' (Table II) and has attracted much debate, but will be discussed here alongside the well-established 1981 scheme.

The classification scheme is based on the widely accepted concept that there are two patterns of epileptic discharge: those arising from focal cortical disturbances; and those characterised by immediate synchronous spike-wave discharge of both hemispheres. Partial seizures begin locally in the cortex and ictal semiology may reflect the functional role of that part of the cortex in which the seizure begins. These are differentiated from generalised seizures which commence bilaterally and in which consciousness is lost suddenly. Any partial seizure may spread to become generalised with a secondary tonic-clonic seizure. The electroencephalographic (EEG) findings also help differentiate partial and generalised seizures. Inter-ictal EEGs tend to show localised spikes and on occasion associated focal slow waves in patients with partial seizures, but synchronous, high amplitude, generalised spike-wave discharge in patients with primarily generalised seizures.

This long-established dichotomy into 'partial' versus 'generalised' abnormalities has been challenged, and it has been proposed that any new scheme should take a more flexible approach. It is now recognised that there are a variety of conditions between focal and generalised epileptogenic dysfunctions that include diffuse hemispheric abnormalities, multifocal abnormalities, and bilaterally symmetrical localised abnormalities. Epileptologists can argue for hours whether West Syndrome or benign epilepsy with centrotemporal spikes (BECTS) are 'partial' or 'generalised', a debate which can become pointless and lose track of the key task, which is optimal treatment of the person with epilepsy.

Many seizures, when infrequent and less than fully observed, may prove difficult to classify. It is therefore inevitable that seizure classification itself is biased. It is most effective in the classification of seizures which occur frequently in patients with severe

epilepsy, and in whom there is a greater likelihood of observing an EEG correlate of the seizure.

### **Partial or focal seizures**

The 1981 scheme distinguishes between *simple partial* (conscious awareness retained) and *complex partial seizures* (conscious awareness disrupted). More recent ILAE proposals define discrete focal seizure types, without any necessary categorisation into *simple* and *complex*. The most common sites of origin for simple partial seizures are within the frontal or temporal lobes.

#### *Temporal lobe seizures (see Chapter 13)*

A variety of simple partial seizures occur due to temporal lobe disturbance. When the uncus is involved the patient may experience abnormalities of taste or smell, usually of an unpleasant nature. Epigastric rising sensations are common, as are pallor, flushing, and changes in heart rate. Other autonomic changes can accompany temporal lobe disturbances, making their differentiation from syncope difficult. Furthermore, a variety of psychic phenomena may be experienced in seizures with temporal lobe origin without consciousness being impaired. Déjà vu and jamais vu are common, but patients may also perceive auditory or visual hallucinations which seem to represent some form of 'memory playback'. Commonly these experiences may be 'indescribable'.

#### *Frontal lobe seizures (see Chapter 14)*

Frontal seizures most commonly manifest as adersive attacks. It should be noted that adversion does not always indicate a contralateral frontal origin – it may occur in generalised seizures and in seizures arising from frontal or temporal regions (including the ipsilateral hemisphere). Adversive attacks comprise tonic or clonic deviation of the head and eyes to one side, often associated with jerking of the arm on that side, or the adoption of a raised flexed posture of the arm. On occasion seizures may begin similarly in the leg. This form of frontal lobe seizure is much more common than the classically described Jacksonian seizure with a recruiting march over the motor cortex. Both types of motor seizure may be followed by a Todd's hemiparesis. Involvement of the frontal speech areas may give rise to sudden speech arrest, or unintelligible muttering. Complex partial seizures may also originate in the frontal lobes when they are characterised by sudden loss of consciousness with immediate often bilateral automatism. They are brief with rapid recovery of consciousness, frequent and tend to occur during sleep. They may appear bizarre and can be misdiagnosed as non-epileptic seizures.

#### *Occipital and parietal lobe seizures (see Chapter 15)*

Other types of simple partial seizures are less common. Those arising from the parietal region are often characterised by positive sensory disturbance and paraesthesiae. Occipital seizures are uncommon and may cause the perception of balls of lights, or colours, usually confined to the contralateral half of the visual field.

#### *Complex partial seizures*

Complex partial seizures, previously termed psychomotor seizures, are differentiated from simple partial seizures by varying degrees of impairment of consciousness. This impairment of consciousness may be preceded by symptoms of simple partial type, usually those associated with a temporal lobe origin. However, in some instances consciousness may be lost at the outset of the seizure. One of the virtues of the 1981 classification is that the temporal progression of a seizure from *simple* to *complex* and indeed to *secondary generalised* is readily accommodated; more recent proposals may appear to have discarded this potentially clinically useful concept.

Such seizures are not infrequently associated with ictal automatisms which are most commonly crude and stereotyped (smacking of the lips with facial movements, fidgeting and picking at the clothes). Occasionally more complex behaviour is seen, which on occasions may lead to arrest for shoplifting, or indecent exposure. Complex partial seizures are frequently succeeded by post-ictal confusion. It is generally believed that the impaired consciousness and automatism of complex partial seizures result from ictal activity in the limbic system, either unilaterally or bilaterally. Both simple and complex partial seizures may spread more generally to involve both hemispheres and result in a tonic-clonic seizure.

## **Generalised seizures**

### *Tonic-clonic seizures*

The most common form of generalised seizure (whether this occurs in a primary fashion or following secondary generalisation after a partial seizure) is the tonic-clonic seizure. When of primary origin the patient experiences no aura but may describe a more non-specific and longer lasting prodrome of general malaise. The patient initially cries out during a tonic phase of extension and opisthotonus, associated with respiratory arrest and cyanosis. Reflex emptying of the bladder and bowel may occur. Next the patient enters a clonic phase of rhythmic generalised jerking lasting for a variable length of time. Less commonly only tonic or clonic phases may be seen. Deep coma follows with an ascending conscious level which often includes a post-ictal phase of confusion and automatic behaviour. On becoming fully conscious, usually within 15–60 minutes, the patient may experience generalised aches and pains consequent on uncoordinated muscle activity, become aware of a bitten tongue, and have a generalised headache and a feeling of lethargy with a desire to sleep.

### *Typical absences*

These are characterised by sudden, usually momentary, absence during which a child loses contact with the surroundings and stops the activity he was involved in. There may be some minor myoclonic activity around the eyelids. These attacks may occur very frequently during the course of the day and the child is frequently unaware of their occurrence. This form of epilepsy may declare itself as learning difficulties at school, due to the effects that such frequent seizures have on the ability to concentrate. It is associated with regular 3 Hz spike-wave activity and is usually precipitated by hyperventilation.

### *Atypical absences*

Atypical absences are more common, and usually occur as a symptomatic epilepsy in children with pre-existing brain damage. Absences are more prolonged, and frequently associated with myoclonic activity or atonic attacks, both of which may result in the child being thrown to the ground, frequently suffering trauma.

### *Myoclonic jerks*

Brief myoclonic jerks occur in a number of differing syndromes, including many syndromes without epilepsy. They may be associated with typical or atypical absences but more commonly occur without impairment of consciousness. The arms tend to be most frequently involved in a sudden flexion movement.

### *Tonic and atonic seizures*

Tonic and atonic seizures may be seen in the severe childhood epilepsies (see Chapter 7). They may also occasionally be seen in children and adults without cognitive impairment or other deficits.

## Status epilepticus

Seizures are almost always self-limiting. Rarely one may follow another in close succession, resulting in status.

### *Convulsive status*

This is a state of recurrent tonic-clonic seizures without recovery of consciousness between attacks. It represents a medical emergency with a high morbidity and mortality. Status may occur in approximately 3% of epileptic patients but is most common in patients with severe epilepsy who are non-compliant with drug therapy. It may also occur in alcohol withdrawal, in acute meningitis or encephalitis, and in other metabolic disturbances. An initial presentation with status epilepticus is particularly common with frontal lobe lesions such as tumour or abscess.

### *Absence status*

This may be seen in children who exhibit confused behaviour, and an epileptic basis for this mental state may not be immediately apparent. The presence of blinking or minor myoclonic jerks may be helpful and the EEG will show continuous spike-wave activity. The condition usually responds well to intravenous diazepam and is much more commonly seen in secondary generalised epilepsies of childhood than in idiopathic generalised epilepsy.

### *Complex partial status*

This phenomenon is rarer than absence status. Patients exhibit an abnormal mental state, with confusion and disorientation which is frequently associated with both automatic behaviour and subsequent amnesia for the period of time during which these events occurred.

### *Epilepsia partialis continua*

This consists of repetitive rhythmic jerking of groups of muscles in the arm, leg or face, originally described in association with epidemic encephalitis in Russia. However, the syndrome is seen most frequently in association with vascular disease, and with tumours. The jerking may last for hours, days or even weeks at a time and tends to be highly refractory to conventional antiepileptic drugs, although it may be suppressed for a short time by treatment with diazepam.

## Relative frequency of seizure types

Data on the relative frequency of seizure types is unsatisfactory, and is largely based on populations of patients with relatively severe epilepsy, including large numbers of patients with partial epilepsies. Furthermore, the milder the epilepsy the more difficult it is to determine on clinical and electroencephalographic grounds whether it is of primary generalised or partial type. With these restrictions in mind, most series would suggest that approximately one-third of epilepsies may be of a generalised type, whilst two-thirds are partial, most commonly with a temporal lobe origin (Table III).

## References

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**Table I.** 1981 International classification of seizures<sup>1</sup>.

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**Partial seizures beginning locally**

Simple (consciousness not impaired)

- With motor symptoms
- With somatosensory or special sensory symptoms
- With autonomic symptoms
- With psychic symptoms

Complex (with impairment of consciousness)

- Beginning as simple partial seizure (progressing to complex seizure)
- Impairment of consciousness at onset
  - a) Impairment of consciousness only
  - b) With automatism

Partial seizures becoming secondarily generalised

**Generalised seizures**

Absence seizures

- Typical
- Atypical

Myoclonic seizures

Clonic seizures

Tonic seizures

Tonic-clonic seizures

Atonic seizures

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**Table II.** Proposed new ILAE classification scheme<sup>2, 3, 5</sup>

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**Generalised seizures**

*Tonic-clonic (in any combination)*

*Absence*

Typical

Atypical

Absence with special features

Myoclonic absence

Eyelid myoclonia

*Myoclonic*

Myoclonic

Myoclonic atonic

Myoclonic tonic

*Clonic*

*Tonic*

*Atonic*

**Focal seizures**

**Unknown**

Epileptic spasms

**Continuous seizure types**

*Generalised status epilepticus*

Generalised tonic-clonic status epilepticus

Clonic status epilepticus

Absence status epilepticus

Tonic status epilepticus

Myoclonic status epilepticus

*Focal status epilepticus*

Epilepsia partialis continua of Kojevnikov

Aura continua

Limbic status epilepticus (psychomotor status)

Hemiconvulsive status with hemiparesis

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**Table III.** Incidence of epilepsies and seizure types. Population of 1505 patients with non-febrile seizures from Aarhus, Denmark<sup>4</sup>.

<b>Seizure type</b>	<b>Percentage</b>
Primary tonic-clonic	25.6
Absence	3.9
Myoclonic	3.1
Simple partial seizures	4.9
Complex partial seizures	17.9
Partial + tonic-clonic	14.4
Alcohol-induced seizures	6.3
Stress-induced seizures	8.0
Drug-induced seizures	1.3
Isolated unprovoked seizures	13.4
Unclassified	1.2
Total	100.0