

# Proposal for Revised Clinical and Electroencephalographic Classification of Epileptic Seizures

From the Commission on Classification and Terminology of the International League Against Epilepsy\*

In 1969, the International League Against Epilepsy published a scheme for classification of epileptic seizures. Professor H. Gastaut, then Secretary-General of ILAE and a member of the Commission on Classification, related the history of the work which represents a milestone in efforts at classifying epileptic seizures and has led to world-wide adoption (Gastaut, 1970).

Since the publication of the 1969 classification, objective and sophisticated methods for studying epileptic seizures have become commonplace. These methods include video display of epileptic seizures on magnetic tape, the simultaneous recording of the electroencephalogram using hard-wired recording techniques and radiotelemetry with split screen display and instant replay capability.

Since 1975, two further Commissions on Classification and Terminology of the International League Against Epilepsy have convened in order to continue to update, amend, and improve the classification in the light of the capability afforded by the newer techniques to study seizures. Several workshops were convened. In December 1975 a workshop on complex partial seizures took place at Bethesda, Maryland, under a Commission chaired by Jerome K. Merlis of Baltimore and comprising Dr.

Merlis, Dr. D. David Daly of Dallas, Dr. Dieter Janz of Berlin, Dr. J. Kiffin Penry of Bethesda, Dr. Carlo Alberto Tassinari of Marseille. In addition, Dr. Rudolph Dreyer of Bethel, Dr. Antonio V. Escueta of Los Angeles, Dr. K. F. Masuhr of Berlin, Dr. Richard H. Mattson of New Haven, Dr. Roger J. Porter of Bethesda, Dr. Dieter Schmidt of Berlin, and Dr. Gregory O. Walsh of Los Angeles attended as participants and discussants in this workshop.

In 1977, a workshop on generalized seizures was held in Berlin. The above Commission members were present with the addition of Dr. Toyoji Wada of Shizuoka and invited participants who presented videotape data, including Dr. A. Cirignotta of Bologna, Dr. Peter Kellaway of Houston, Dr. Cesare Lombroso of Boston, Dr. K. F. Masuhr of Berlin, and Dr. D. Stefan of Bonn. The results of these workshops comprise the major portions of the version of the International Classification of Epileptic Seizures herewith proposed.

In 1979, the present Commission was constituted, consisting of Dr. Jean Bancaud of Paris, Dr. Olaf Henriksen of Oslo, Dr. Francisco Rubio-Donnadieu of Mexico City, Dr. Masakatsu Seino of Shizuoka, Dr. Fritz E. Dreifuss of Charlottesville (Chairman), and Dr. J. Kiffin Penry, President of

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the ILAE (*ex-officio*). The charge to the Commission was to: (1) complete the development of a revision of the International Classification of Epileptic Seizures based upon a study of videotapes of simultaneously recorded electrical and clinical manifestations of epileptic seizures; (2) obtain the majority approval of the Classification of Epileptic Seizures from the active chapters of the League and other pertinent international societies; (3) promote the use of this classification throughout the world; (4) develop a current dictionary of epilepsy and promote its use throughout the world; (5) develop a classification of the epilepsies, acquire approval of a classification, and promote its use throughout the world.

A further video workshop, this time addressing variations of absence seizures, was held in Bethesda. In addition to members of the Commission, Dr. Roger J. Porter of Bethesda and Dr. Carlo Alberto Tasinari of Bologna attended the workshop.

Subsequent meetings of the Commission were held in conjunction with the Epilepsy International Meetings in Florence in 1979 and in Copenhagen in 1980. Between these two meetings, each chapter of the ILAE received a draft copy of the proposed revised classification. Many chapters discussed the proposal *in extenso* and provided feedback to the Commission, and this was incorporated in a further revision which resulted from discussions held by the Commission and representatives from many of the chapters at Copenhagen. A subsequent revision was circulated to all the chapters of the ILAE once more, as well as to the International Federation of Societies of Electroencephalography and Clinical Neurophysiology and the World Federation of Neurosurgical Societies.

The present proposal does not represent a unanimity of views. There are those who would prefer the substitution of "focal" for "partial" in the description of seizures. The compromise to retain "partial" stems from the compromise arrived at on this very

point in the formulation of the 1969 classification. A more persuasive argument existed for abolishing the words "simple" and "complex" in favor of "partial seizures with retention of consciousness" and "partial seizures with disturbance of consciousness". Some considered that epileptic syndromes or fragments of syndromes such as hemicorporeal seizures of childhood, infantile spasms, and myoclonic astatic seizures should be preserved.

What resulted is a compromise which represents a synthesis of the efforts of many persons examining hundreds of seizures over many years. This compilation of knowledge has been brought in line with the state-of-the-art technology without extrapolating to what cannot be observed, but cognizant of the evanescence of any living semantic endeavor which must remain subject to continual revision.

## INTRODUCTION

Attempts at classification of seizures have to a large extent paralleled knowledge about these disorders, so much so that it is not clear whether the classification is the father or the child of our concepts. It is certain that recent advances in knowledge about inheritance, prognosis, and therapy of seizures have been predicated on ability to distinguish accurately between their different forms and to objectively identify and measure their effects.

The concept of classification according to the defect of function, prognosis, and the optimum mode of therapy is relatively recent. Earlier classifications were particularly aimed at describing presenting symptoms and elucidating which seizures were primarily on an organic basis and which were primarily on a hysterical basis. Thus, the classification of Gowers was into grand mal, petit mal, and hysteroid. Jackson realized that a single classification could not meet all needs and suggested an anatomicophysiological classification and one based on taxonomy and purely utilitar-

## PROPOSAL FOR REVISED SEIZURE CLASSIFICATION

ian; he compared the first to a botanical and the second to a gardener's arrangement of plants. Of the latter, he said: "Plainly enough, such an arrangement goes by what is most superficial or striking. The advantages of it are obvious. It facilitates the identification and the application of knowledge to utilitarian purposes, but it must not be trusted as a natural classification. However much of it may be further elaborated, it makes not even an approach to a scientific classification" (Jackson, 1931).

The concept of classification into generalized and partial seizures, while dating back to Jackson, did not become common usage until developed by the Commission on Classification of the International League Against Epilepsy in 1969. The development of new and more specific drugs reinforced the necessity for the development of more accurate diagnosis and quantification. Moreover, increased knowledge about side effects of medications have raised questions regarding which seizures should be treated for which length of time, necessitating the development of prognostic criteria, again based on the accuracy of classification.

Apart from the heuristic value of such a classification, it is of great importance that for purposes of communication, unanimity of terminology be attained. This is especially important in clinical research.

The main feature of the 1969 classification is a distinction between seizures that are generalized from the beginning and those that are partial or focal at onset and become generalized secondarily.

The last 5 years have seen the development and diversification of objective methods for documenting seizures, including prolonged EEG recording and the use of videotape, which allows for capture and availability for review of seizures. Using these techniques, investigators all over the world have a common medium for exchange of information and this was used in the further elaboration of the proposed classification in a series of workshop ses-

sions in 1975, 1977, and 1979. The first addressed the classification of partial seizures, the second, generalized seizures and the last, the categories of atypical absence seizures and the various seizures seen in infancy and childhood.

The convention of describing (1) clinical seizure type, (2) electroencephalographic seizure type, (3) electroencephalographic interictal expression, (4) anatomic substrate, (5) etiology, and (6) age has been changed from the 1969 International Classification.

Only clinical seizure type and ictal and interictal electroencephalographic expressions have been retained. The anatomic substrate, etiology, and age factors have been deleted as they were largely based on historical or speculative information rather than information based on direct observation. In a description of seizures, rather than epilepsy, the latter should be the only consideration.

With further elaboration of monitoring technology, changes in other physiological parameters will, in future, be included under ictal expression.

The other major distinction from the previous version is the separation of partial seizures into simple and complex depending on whether or not consciousness is disturbed. In the case of the complex partial seizure, the sequence is crucial, that is, even if the onset is a simple partial one, the occurrence of disturbance of consciousness evolves into a complex partial seizure. Thus, unlike the 1969 version, the current proposal allows for longitudinal description of evolving seizure manifestations, thereby improving descriptive accuracy.

The Commission recommends that simple seizures be classified as those with retention of consciousness and complex seizures be those in which consciousness is impaired. Many persons feel that the term "complex" refers to higher cortical integrative function disturbances and would prefer that we abandon the terms "simple"

and "complex" and substitute simply partial seizures with retention of consciousness and partial seizures with disturbance of consciousness (1) with impairment of consciousness only, and (2) with automatisms, thereby completely avoiding the terms simple and complex. While the logic is attractive, this system would introduce more confusion at this stage, as most epileptologists have been indoctrinated in the previous terminology in which, without adequate anatomical justification, there was the implication that the term "partial seizures with complex symptomatology" was synonymous with the old term "psychomotor epilepsy."

If the meaning of the terms is carefully defined, as it is in the attached glossary, the proposal as it stands would seem to be a satisfactory bridge between the 1969 classification and the ultimate ideal while preserving the concept of evolution rather than revolution in the elaboration of the classification into a workable and acceptable document.

It must be stressed that the present classification is weighted clinically and should not be construed as representing the last word in identification of the origin of the epileptic seizure, its spread through the cerebrum, or its elaboration in the mobilization of this or that structure in its propagation.

Nor is the classification sacrosanct. The terminology represents that which can be seen and agreed upon by representative observers. With increasing knowledge, the categories may change, the skeleton will be "fleshed out" and the nuances elaborated. It is hoped that the classification in itself will aid in mobilizing those concepts which will lead to its modification in time. Thus, the Commission does not believe that 12 years after the 1969 version is too soon for the proposed revision, as that which is better must replace that which is flawed and, in turn, will yield to further improvements.

The glossary defines the terms used and

should be referred to in conjunction with the classification to obviate any potential semantic ambiguities.

Finally, it must be stressed that this is not a classification of the epilepsies. It is a classification of epileptic seizures.

A classification of epileptic syndromes whose terminology is used daily in communication between colleagues and as diagnostic entries in hospital records and which forms the subject of clinical trials and other investigations is the next logical area for the Commission to address after adoption of the present basic schema. At that stage such putative syndromic seizure types as Rolandic seizures, unilateral (hemicorporeal) seizures in children, infantile spasms, and astatic-myoclonic seizures (Lennox-Gastaut syndrome) will find appropriate recognition.

## DEFINITION OF TERMS

Each seizure type will be described so that the criteria used will not be in doubt.

### Partial Seizures

The fundamental distinction between simple partial seizures and complex partial seizures is the presence or the impairment of the fully conscious state.

Consciousness has been defined as "that integrating activity by which Man grasps the totality of his phenomenal field" (Evans, 1972) and incorporates it into his experience. It corresponds to "Bewusstsein" and is thus much more than "Vigilance," for were it only vigilance (which is a degree of clarity) then only confusional states would be representative of disordered consciousness.

Operationally in the context of this classification, *consciousness* refers to the degree of awareness and/or responsiveness of the patient to externally applied stimuli. *Responsiveness* refers to the ability of the patient to carry out simple commands or willed movement and *awareness* refers to the patient's contact with events during the

## I. PARTIAL (FOCAL, LOCAL) SEIZURES

Partial seizures are those in which, in general, the first clinical and electroencephalographic changes indicate initial activation of a system of neurons limited to part of one cerebral hemisphere. A partial seizure is classified primarily on the basis of whether or not consciousness is impaired during the attack. When consciousness is not impaired, the seizure is classified as a simple partial seizure. When consciousness is impaired, the seizure is classified as a complex partial seizure. Impairment of consciousness may be the first clinical sign, or simple partial seizures may evolve into complex partial seizures. In patients with impaired consciousness, aberrations of behavior (automatisms) may occur. A partial seizure may not terminate, but instead progress to a generalized motor seizure. Impaired consciousness is defined as the inability to respond normally to exogenous stimuli by virtue of altered awareness and/or responsiveness (vide infra: Definition of Terms).

There is considerable evidence that simple partial seizures usually have unilateral hemispheric involvement and only rarely have bilateral hemispheric involvement; complex partial seizures, however, frequently have bilateral hemispheric involvement.

Partial seizures can be classified into one of the following three fundamental groups:

- A. Simple partial seizures
- B. Complex partial seizures
  1. With impairment of consciousness at onset
  2. Simple partial onset followed by impairment of consciousness
- C. Partial seizures evolving to generalized tonic-clonic convulsions (GTC)
  1. Simple evolving to GTC
  2. Complex evolving to GTC (including those with simple partial onset)

Clinical seizure type	EEG seizure type	EEG interictal expression
A. <i>Simple partial seizures</i> (consciousness not impaired)	Local contralateral discharge starting over the corresponding area of cortical representation (not always recorded on the scalp)	Local contralateral discharge
1. With motor signs <ol style="list-style-type: none"> <li>(a) focal motor without march</li> <li>(b) Focal motor with march (Jacksonian)</li> <li>(c) Versive</li> <li>(d) Postural</li> <li>(e) Phonatory (vocalization or arrest of speech)</li> </ol>		
2. With somatosensory or special-sensory symptoms (simple hallucinations, e.g., tingling, light flashes, buzzing) <ol style="list-style-type: none"> <li>(a) Somatosensory</li> <li>(b) Visual</li> <li>(c) Auditory</li> <li>(d) Olfactory</li> <li>(e) Gustatory</li> <li>(f) Vertiginous</li> </ol>		
3. With autonomic symptoms or signs (including epigastric sensation, pallor, sweating, flushing, pilo-erection and pupillary dilatation)		
4. With psychic symptoms (disturbance of higher cerebral function). These symptoms rarely occur without impairment of consciousness and are much more commonly experienced as complex partial seizures <ol style="list-style-type: none"> <li>(a) Dysphasic</li> <li>(b) Dysmnestic (e.g., déjà-vu)</li> <li>(c) Cognitive (e.g., dreamy states, distortions of time sense)</li> <li>(d) Affective (fear, anger, etc.)</li> </ol>		

(contd.)

Clinical seizure type	EEG seizure type	EEG interictal expression
(e) Illusions (e.g., macropsia)		
(f) Structured hallucinations (e.g., music, scenes)		
<b>B. Complex partial seizures</b> (with impairment of consciousness; may sometimes begin with simple symptomatology)	Unilateral or, frequently bilateral discharge, diffuse or focal in temporal or frontotemporal regions	Unilateral or bilateral generally asynchronous focus; usually in the temporal or frontal regions
1. Simple partial onset followed by impairment of consciousness		
(a) With simple partial features (A.1. - A.4.) followed by impaired consciousness		
(b) With automatisms		
2. With impairment of consciousness at onset		
(a) With impairment of consciousness only		
(b) With automatisms		
<b>C. Partial seizures evolving to secondarily generalized seizures</b> (This may be generalized tonic-clonic, tonic, or clonic)	Above discharges become secondarily and rapidly generalized	
1. Simple partial seizures (A) evolving to generalized seizures		
2. Complex partial seizures (B) evolving to generalized seizures		
3. Simple partial seizures evolving to complex partial seizures evolving to generalized seizures		

## II. GENERALIZED SEIZURES (CONVULSIVE OR NONCONVULSIVE)

Generalized seizures are those in which the first clinical changes indicate initial involvement of both hemispheres. Consciousness may be impaired and this impairment may be the initial manifestation. Motor manifestations are bilateral. The ictal electroencephalographic patterns initially are bilateral, and presumably reflect neuronal discharge which is widespread in both hemispheres.

Clinical seizure type	EEG seizure type	EEG interictal expression
<b>A. 1. Absence seizures</b>		
(a) Impairment of consciousness only	Usually regular and symmetrical 3 Hz but may be 2-4 Hz spike-and-slow-wave complexes and may have multiple spike-and-slow-wave complexes. Abnormalities are bilateral	Background activity usually normal although paroxysmal activity (such as spikes or spike-and-slow-wave complexes) may occur. This activity is usually regular and symmetrical
(b) With mild clonic components		
(c) With atonic components		

(contd.)

Clinical seizure type	EEG seizure type	EEG interictal expression
(d) With tonic components (e) With automatisms (f) With autonomic components (b through f may be used alone or in combination)		
2. <i>Atypical absence</i>	EEG more heterogeneous; may include irregular spike-and-slow-wave complexes, fast activity or other paroxysmal activity. Abnormalities are bilateral but often irregular and asymmetrical	Background usually abnormal: paroxysmal activity (such as spikes or spike-and-slow-wave complexes) frequently irregular and asymmetrical
May have: (a) Changes in tone that are more pronounced than in A.1 (b) Onset and/or cessation that is not abrupt		
B. <i>Myoclonic seizures</i> Myoclonic jerks (single or multiple)	Polyspike and wave, or sometimes spike and wave or sharp and slow waves	Same as ictal
C. <i>Clonic seizures</i>	Fast activity (10 c/sec or more) and slow waves; occasional spike-and-wave patterns	Spike-and-wave or polyspike-and-wave discharges
D. <i>Tonic seizures</i>	Low voltage, fast activity or a fast rhythm of 9-10 c/sec or more decreasing in frequency and increasing in amplitude	More or less rhythmic discharges of sharp and slow waves, sometimes asymmetrical. Background is often abnormal for age
E. <i>Tonic-clonic seizures</i>	Rhythm at 10 or more c/sec decreasing in frequency and increasing in amplitude during tonic phase, interrupted by slow waves during clonic phase	Polyspike and waves or spike and wave, or, sometimes, sharp and slow wave discharges
F. <i>Atonic seizures</i> (Astatic) (combinations of the above may occur, e.g., B and F, B and D)	Polyspikes and wave or flattening or low-voltage fast activity	Polyspikes and slow wave

### III. UNCLASSIFIED EPILEPTIC SEIZURES

Includes all seizures that cannot be classified because of inadequate or incomplete data and some that defy classification in hitherto described categories. This includes some neonatal seizures, e.g., rhythmic eye movements, chewing, and swimming movements.

### IV. ADDENDUM

Repeated epileptic seizures occur under a variety of circumstances:

1. as fortuitous attacks, coming unexpectedly and without any apparent provocation; 2. as cyclic attacks, at more or less regular intervals (e.g., in relation to the menstrual cycle, or the sleep-waking cycle); 3. as attacks provoked by: (a) nonsensory factors (fatigue, alcohol, emotion, etc.), or (b) sensory factors, sometimes referred to as "reflex seizures."

Prolonged or repetitive seizures (status epilepticus). The term "status epilepticus" is used whenever a seizure persists for a sufficient length of time or is repeated frequently enough that recovery between attacks does not occur. Status epilepticus may be divided into partial (e.g., Jacksonian), or generalized (e.g., absence status or tonic-clonic status). When very localized motor status occurs, it is referred to as *epilepsia partialis continua*.

period in question and its recall. A person aware and unresponsive will be able to recount the events that occurred during an attack and his inability to respond by movement or speech. In this context, unresponsiveness is other than the result of paralysis, aphasia or apraxia.

#### A. *Partial Seizures*

1. *With motor signs.* Any portion of the body may be involved in focal seizure activity depending on the site of origin of the attack in the motor strip. Focal motor seizures may remain strictly focal or they may spread to contiguous cortical areas producing a sequential involvement of body parts in an epileptic "march." The seizure is then known as a Jacksonian seizure. Consciousness is usually preserved; however, the discharge may spread to those structures whose participation is likely to result in loss of consciousness and generalized convulsive movements. Other focal motor attacks may be versive with head turning to one side, usually contraversive to the discharge. If speech is involved, this is either in the form of speech arrest or occasionally vocalization. Occasionally a partial dysphasia is seen in the form of epileptic pallilalia with involuntary repetition of a syllable or phrase.

Following focal seizure activity, there may be a localized paralysis in the previously involved region. This is known as Todd's paralysis and may last from minutes to hours.

When focal motor seizure activity is continuous it is known as *epilepsia partialis continua*.

2. *Seizures with autonomic symptoms* such as vomiting, pallor, flushing, sweating, piloerection, pupil dilatation, boborygmi, and incontinence may occur as simple partial seizures.

3. *With somatosensory or special sensory symptoms.* Somatosensory seizures arise from those areas of cortex subserving sensory function, and they are usually de-

scribed as pins-and-needles or a feeling of numbness. Occasionally a disorder of proprioception or spatial perception occurs. Like motor seizures, somatosensory seizures also may march and also may spread at any time to become complex partial or generalized tonic-clonic seizures as in A.1. Special sensory seizures include visual seizures varying in elaborateness and depending on whether the primary or association areas are involved, from flashing lights to structured visual hallucinatory phenomena, including persons, scenes, etc. (see A.4.f.). Like visual seizures, auditory seizures may also run the gamut from crude auditory sensations to such highly integrated functions as music (see A.4.f.). Olfactory sensations, usually in the form of unpleasant odors, may occur.

Gustatory sensations may be pleasant or odious taste hallucinations. They vary in elaboration from crude (salty, sour, sweet, bitter) to sophisticated. They are frequently described as "metallic."

Vertiginous symptoms include sensations of falling in space, floating, as well as totatory vertigo in a horizontal or vertical plane.

4. *With psychic symptoms* (disturbance of higher cerebral function). These usually occur with impairment of consciousness (i.e., complex partial seizures).

a. *Dysphasia.* This was referred to earlier.

b. *Dysmnestic symptoms.* A distorted memory experience such as distortion of the time sense, a dreamy state, a flashback, or a sensation as if a naive experience had been experienced before, known as *déjà vu*, or as if a previously experienced sensation had not been experienced, known as *jamais-vu*, may occur. When this refers to auditory experiences these are known as *déjà-entendu* or *jamais-entendu*. Occasionally as a form of forced thinking, the patient may experience a rapid recollection of episodes from his past life, known as panoramic vision.

c. *Cognitive disturbances* may be experi-

enced. These include dreamy states; distortions of the time sense; sensations of unreality, detachment, or depersonalization.

- d. With affective symptomatology. Sensation of extreme pleasure or displeasure, as well as fear and intense depression with feelings of unworthiness and rejection may be experienced during seizures. Unlike those of psychiatrically induced depression, these symptoms tend to come in attacks lasting for a few minutes. Anger or rage is occasionally experienced, but unlike temper tantrums, epileptic anger is apparently unprovoked, and abates rapidly. Fear or terror is the most frequent symptom; it is sudden in onset, usually unprovoked, and may lead to running away. Associated with the terror, there are frequently objective signs of autonomic activity, including pupil dilatation, pallor, flushing, piloerection, palpitation, and hypertension.

Epileptic or gelastic seizure laughter should not, strictly speaking, be classed as an affective symptom because the laughter is usually without affect and hollow. Like other forms of pathological laughter it is often unassociated with true mirth.

- e. Illusions. These take the form of distorted perceptions in which objects may appear deformed. Polyoptic illusions such as monocular diplopia, distortions of size (macropsia or micropsia) or of distance may occur. Similarly, distortions of sound, including microacusia and macroacusia, may be experienced. Depersonalization, as if the person were outside his body, may occur. Altered perception of size or weight of a limb may be noted.
- f. Structured hallucinations. Hallucinations may occur as manifestations or perceptions without a corresponding external stimulus and may affect somatosensory, visual, auditory, olfactory, or gustatory

senses. If the seizure arises from the primary receptive area, the hallucination would tend to be rather primitive. In the case of vision, flashing lights may be seen; in the case of auditory perception, rushing noises may occur. With more elaborate seizures involving visual or auditory association areas with participation of mobilized memory traces, formed hallucinations occur and these may take the form of scenery, persons, spoken sentences, or music. The character of these perceptions may be normal or distorted.

### B. Seizures with Complex Symptomatology

*Automatisms.* (These may occur in both partial and generalized seizures. They are described in detail here for convenience.) In the *Dictionary of Epilepsy* (Gastaut, 1973), automatisms are described as "more or less coordinated adapted (eupractic or dyspractic) involuntary motor activity occurring during the state of clouding of consciousness either in the course of, or after an epileptic seizure, and usually followed by amnesia for the event. The automatism may be simply a continuation of an activity that was going on when the seizure occurred, or, conversely, a new activity developed in association with the ictal impairment of consciousness. Usually, the activity is commonplace in nature, often provoked by the subject's environment, or by his sensations during the seizure; exceptionally, fragmentary, primitive, infantile, or antisocial behavior is seen. From a symptomatological point of view the following are distinguished: a) eating automatisms (chewing, swallowing); b) automatisms of mimicry, expressing the subject's emotional state (usually of fear) during the seizure; c) gestural automatisms, crude or elaborate; directed toward either the subject or his environment; d) ambulatory automatisms; e) verbal automatisms."

Ictal epileptic automatisms usually repre-

sent the release of automatic behavior under the influence of clouding of consciousness that accompanies a generalized or partial epileptic seizure (confusional automatisms). They may occur in complex partial seizures as well as in absence seizures. Postictal epileptic automatisms may follow any severe epileptic seizure, especially a tonic-clonic one, and are usually associated with confusion.

While some regard masticatory or oropharyngeal automatisms as arising from the amygdala or insular and opercular regions, these movements are occasionally seen in the generalized epilepsies, particularly absence seizures, and are not of localizing help. The same is true of mimicry and gestural automatisms. In the latter, fumbling of the clothes, scratching, and other complex motor activity may occur both in complex partial and absence seizures. Ictal speech automatisms are occasionally encountered. Ambulatory seizures again may occur either as prolonged automatisms of absence, particularly prolonged absence continuing, or of complex partial seizures. In the latter, a patient may occasionally continue to drive a car, although may contravene traffic light regulations.

There seems to be little doubt that automatisms are a common feature of different types of epilepsy. While they do not lend themselves to simple anatomic interpretation, they appear to have in common a discharge involving various areas of the limbic system. Crude and elaborate automatisms do occur in patients with absence as well as complex partial seizures. Of greater significance is the precise descriptive history of the seizures, the age of the patient, the presence or absence of an aura and of postictal behavior including the presence or absence of confusion. The EEG is of cardinal localizational importance here.

*Drowsiness or somnolence* implies a sleep state from which the patient can be

aroused to make appropriate motor and verbal responses. In stupor, the patient may make some spontaneous movement and can be aroused by painful or other vigorously applied stimuli to make avoidance movements. The patient in confusion makes inappropriate responses to his environment and is disoriented as regards place or time or person.

*Aura.* A frequently used term in the description of epileptic seizures is aura. According to the *Dictionary of Epilepsy*, this term was introduced by Galen to describe the sensation of a breath of air felt by some subjects prior to the onset of a seizure. Others have referred to the aura as the portion of a seizure experienced before loss of consciousness occurs. This loss of consciousness may be the result of secondary generalization of the seizure discharge or of alteration of consciousness imparted by the development of a complex partial seizure.

The aura is that portion of the seizure which occurs before consciousness is lost and for which memory is retained afterwards. It may be that, as in simple partial seizures, the aura is the whole seizure. Where consciousness is subsequently lost, the aura is, in fact, the signal symptom of a complex partial seizure.

An aura is a retrospective term which is described after the seizure is ended.

## Generalized Seizures

### A. Absence Seizures

The hallmark of the absence attack is a sudden onset, interruption of ongoing activities, a blank stare, possibly a brief upward rotation of the eyes. If the patient is speaking, speech is slowed or interrupted; if walking, he stands transfixed; if eating, the food will stop on his way to the mouth. Usually the patient will be unresponsive when spoken to. In some, attacks are aborted when the patient is spoken to. The attack lasts from a few seconds to half a minute and evaporates as rapidly as it commenced.

1. *Absence with impairment of consciousness only.* The above description fits the description of absence simple in which no other activities take place during the attack.

2. *Absence with mild clonic components.* Here the onset of the attack is indistinguishable from the above, but clonic movements may occur in the eyelids, at the corner of the mouth, or in other muscle groups which may vary in severity from almost imperceptible movements to generalized myoclonic jerks. Objects held in the hand may be dropped.

3. *Absence with atonic components.* Here there may be a diminution in tone of muscles subserving posture as well as in the limbs leading to drooping of the head, occasionally slumping of the trunk, dropping of the arms, and relaxation of the grip. Rarely, tone is sufficiently diminished to cause this person to fall.

4. *Absence with tonic components.* Here during the attack tonic muscular contraction may occur, leading to increase in muscle tone which may affect the extensor muscles or the flexor muscles symmetrically or asymmetrically. If the patient is standing the head may be drawn backward and the trunk may arch. This may lead to retropulsion. The head may tonically draw to one or another side.

5. *Absence with automatisms.* (See also prior discussion on automatisms.) Purposeful or quasipurposeful movements occurring in the absence of awareness during an absence attack are frequent and may range from lip licking and swallowing to clothes fumbling or aimless walking. If spoken to the patient may grunt or turn to the spoken voice and when touched or tickled may rub the site. Automatisms are quite elaborate and may consist of combinations of the above-described movements or may be so simple as to be missed by casual observation. Mixed forms of absence frequently occur.

## B. Tonic-Clonic Seizures

The most frequently encountered of the generalized seizures are the generalized tonic-clonic seizures, often known as grand mal. Some patients experience a vague ill-described warning, but the majority lose consciousness without any premonitory symptoms. There is a sudden sharp tonic contraction of muscles, and when this involves the respiratory muscles there is stridor, a cry or moan, and the patient falls to the ground in the tonic state, occasionally injuring himself in falling. He lies rigid, and during this stage tonic contraction inhibits respiration and cyanosis may occur. The tongue may be bitten and urine may be passed involuntarily. This tonic stage then gives way to clonic convulsive movements lasting for a variable period of time. During this stage small gusts of grunting respiration may occur between the convulsive movements, but usually the patient remains cyanotic and saliva may froth from the mouth. At the end of this stage, deep respiration occurs and all the muscles relax, after which the patient remains unconscious for a variable period of time and often awakes feeling stiff and sore all over. He then frequently goes into a deep sleep and when he awakens feels quite well apart from soreness and frequently headache. Generalized tonic-clonic convulsions may occur in childhood and in adult life; they are not as frequent as absence seizures, but vary from one a day to one every three months and occasionally to one every few years.

Very short attacks without postictal drowsiness may occur on occasion.

## Myoclonic Seizures

Myoclonic jerks (single or multiple) are sudden, brief, shock-like contractions which may be generalized or confined to the face and trunk or to one or more extremities or even to individual muscles or groups of muscles. Myoclonic jerks may be

rapidly repetitive or relatively isolated. They may occur predominantly around the hours of going to sleep or awakening from sleep. They may be exacerbated by volitional movement (action myoclonus). At times they may be regularly repetitive.

Many instances of myoclonic jerks and action myoclonus are not classified as epileptic seizures. The myoclonic jerks of myoclonus due to spinal cord disease, dys-synergia cerebellaris myoclonica, subcortical segmental myoclonus, paramyoclonus multiplex, and opsoclonus-myoclonus syndrome must be distinguished from epileptic seizures.

### Clonic Seizures

Generalized convulsive seizures occasionally lack a tonic component and are characterized by repetitive clonic jerks. As the frequency diminishes the amplitude of the jerks do not. The postictal phase is usually short. Some generalized convulsive seizures commence with a clonic phase passing into a tonic phase, as described below, leading to a "clonic-tonic-clonic" seizure.

### Tonic Seizures

To quote Gowers, a tonic seizure is "a rigid, violent muscular contraction, fixing the limbs in some strained position. There is usually deviation of the eyes and of the head toward one side, and this may amount to rotation involving the whole body, (sometimes actually causing the patient to turn around, even two or three times. The features are distorted; the color of the face, unchanged at first, rapidly becomes pale and then flushed and ultimately livid as the fixation of the chest by the spasms stops the movements of respiration. The eyes are open or closed; the conjunctiva is insensitive; the pupils dilate widely as cyanosis comes on. As the spasm continues, it commonly changes in its relative intensity in

different parts, causing slight alterations in the position of the limbs."

Tonic axial seizures with extension of head, neck, and trunk may also occur.

### Atonic Seizures

A sudden diminution in muscle tone occurs which may be fragmentary, leading to a head drop with slackening of the jaw, the dropping of a limb or a loss of all muscle tone leading to a slumping to the ground. When these attacks are extremely brief they are known as "drop attacks." If consciousness is lost, this loss is extremely brief. The sudden loss of postural tone in the head and trunk may lead to injury by projecting objects. The face is particularly subject to injury. In the case of more prolonged atonic attacks, the slumping may be progressive in a rhythmic, successive relaxation manner.

(So-called drop attacks may be seen in conditions other than epilepsy, such as brainstem ischemia and narcolepsy catalepsy syndrome.)

### Unclassified Epileptic Seizures

This category includes all seizures that cannot be classified because of inadequate or incomplete data and includes some seizures that by their natures defy classification in the previously defined broad categories. Many seizures occurring in the infant (e.g., rhythmic eye movements, chewing, swimming movements, jittering, and apnea) will be classified here until such time as further experience with video-tape confirmation and electroencephalographic characterization entitles them to subtyping in the extant classification.

### Epilepsia Partialis Continua

Under this name have been described cases of simple partial seizures with focal motor signs without a march, usually consisting of clonic spasms, which remain confined to the part of the body in which they

originate, but which persist with little or no intermission for hours or days at a stretch. Consciousness is usually preserved, but postictal weakness is frequently evident.

#### Postictal Paralysis (Todd's Paralysis)

This category refers to the transient paralysis that may occur following some partial epileptic seizures with focal motor components or with somatosensory symptoms. Postictal paralysis has been ascribed to neuronal exhaustion due to the increased metabolic activity of the discharging focus, but it may also be attributable to increased

inhibition in the region of the focus, which may account for its appearance in non-motor somatosensory seizures.

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