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Special Article

# *Semiological Seizure Classification

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**Summary:** We propose an epileptic seizure classification based exclusively on ictal semiology. In this semiological seizure classification (SSC), seizures are classified as follows:

a. Auras are ictal manifestations having sensory, psychosensory, and experiential symptoms.
b. Autonomic seizures are seizures in which the main ictal manifestations are objectively documented autonomic alterations.
c. "Dialeptic" seizures have as their main ictal manifestations an alteration of consciousness that is independent of ictal EEG manifestations. The new term "dialeptic" seizure has been coined to differentiate this concept from absence seizures (dialeptic seizures with a generalized ictal EEG) and complex partial seizures (dialeptic seizures with a focal ictal EEG).
d. Motor seizures are characterized mainly by motor symptoms and are subclassified as simple or complex. Simple motor seizures are characterized by simple, unnatural movements that can be elicited by electrical stimulation of the primary and supplementary motor area (myoclonic, tonic, clonic and tonic-clonic, versive). Complex motor seizures are characterized by complex motor movements that resemble natural movements but that occur in an inappropriate setting ("automatisms").
e. Special seizures include seizures characterized by "negative" features (atonic, astatic, hypomotor, akinetic, and aphasic seizures).

The SSC identifies in detail the somatotopic distribution of the ictal semiology as well as the seizure evolution. The advantages of a pure SSC, as opposed to the current classification of the International League Against Epilepsy (ILAE), which is actually a classification of electroclinical syndromes, are discussed. **Key Words:** Seizure classification—Ictal semiology—Auras—Motor seizures—Paroxysmal events.

The International League Against Epilepsy (ILAE) introduced a seizure classification in 1981 based on clinical semiology, interictal EEG findings, and ictal EEG patterns (1). The assumption behind such a classification, which is actually a classification of electroclinical features, is the existence of a strict one-to-one correlation between clinical-ictal semiology and interictal/ictal EEG findings. Detailed analysis of clinical semiology and EEG findings shows, however, that this assumption is frequently incorrect (2), particularly for infants (3).

In previous publications, we discussed this point in detail and called for a seizure classification based exclusively on ictal clinical semiology (4). We also believe that all additional clinical information, such as EEG, anatomic neuroimaging, functional neuroimaging, clinical history, neurological examination, and seizure evolution, should be analyzed separately and then integrated to define the epileptic syndrome with precision. Detailed correlations among these different variables will be of great help in better defining the pathophysiology of the seizures and in establishing the significance of different ictal symptoms in the definition of the epileptic syndrome. Such a semiological seizure classification (SSC) stresses the differentiation between epileptic seizures and epileptic syndromes (5) and provides common terms for typical ictal symptoms and types that are independent of

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the underlying EEG pattern, as well as other laboratory information. Herein, we propose an SSC. The classification we present has been tested for >10 years in selected epilepsy centers.

## Overview

Our seizure classification is based exclusively on ictal seizure semiology, either as reported by the patient or observers or as analyzed directly during video monitoring (Table 1). No EEG findings or other test results influence the classification.

Ictal symptoms can be produced by epileptic interference of one of the following four "spheres":

a. Sensorial sphere.
b. Consciousness sphere.
c. Autonomic sphere.
d. Motor sphere.

Seizures affecting the sensorial sphere exclusively produce no objective signs other than an occasional altered behavior by the patient to an "unexpected" experience. We are aware of their occurrence only if the patient tells us of the sensorial experience. We identify these seizures as *auras* in good agreement with classical terminology.

Seizures that interfere primarily with consciousness have been identified by different terms, according to the EEG correlate or to the epileptic syndrome that produces the alteration of consciousness. For example, an episode of altered consciousness associated with generalized 3-Hz, spike-and-wave EEG activity is identified as an absence seizure, whereas if it is associated with a focal epileptiform discharge or occurs in a patient with a focal epileptic syndrome (even in the absence of a local epileptiform correlate), it is identified as a complex partial seizure. To avoid confusion between terms that identify electroclinical complexes (absence seizure and complex partial seizure) and terms that identify pure ictal signs and symptoms, we coined the term *dialeptic seizures* for ictal episodes in which the main manifestation is an alteration of consciousness. The term dialeptic derives from the Greek word "dialeipein," which means "to stand still," "to interrupt," or "to pass out." Other expressions such as "vacant seizures" or "psychoparetic seizures" were also considered, but we believe that a completely new term has advantages when one is trying to define a new concept, i.e., episodes of alteration of awareness that are independent of the associated ictal or interictal EEG changes. Although no consensus was reached between the authors, we tentatively use the term dialeptic seizures herein.

Seizures consisting primarily of autonomic symptoms are rare. Usually, they are detected by the patient reporting symptoms secondary to the autonomic alteration, e.g., palpitations or "hot flashes." Occasionally, they can be documented by appropriate monitoring (e.g., Holter monitor). We classify these episodes as "*autonomic auras*" when the patient has symptoms most probably produced by an autonomic alteration but we do not have objective proof of the autonomic disturbance. In contrast, we classify such episodes as "*autonomic seizures*" when we have objective proof of the autonomic alteration whether the patient is aware of the autonomic disturbance or not.

Seizures in which the main manifestations are motor phenomena are classified as *motor seizures.*

Seizures that cannot be classified in any of the four groups outlined above are categorized as *special seizures.* This category includes primarily seizures characterized by "negative" motor signs (atonic seizure, akinetic seizures, "hypomotor" seizures, and so on).

Seizures frequently include symptoms from two or more spheres. In such case, the seizure is classified according to the *predominant* clinical manifestations. For example, a patient has loss of awareness with slight eye blinking. Such a seizure would be classified as a dialeptic seizure and not as a motor seizure.

The EEG findings (ictal or interictal) are *not* used to classify epileptic seizures in our proposed system. The EEG may be used to differentiate between epileptic seizures and nonepileptic paroxysmal events, however (see section Paroxysmal events).

**TABLE 1.** *Semiological seizure classification*

| | |
|---|---|
| Epileptic seizure | |
| Aura | |
| • Somatosensory aura[a] | • Visual aura[a] |
| • Auditory aura[a] | • Gustatory aura |
| • Olfactory aura | • Autonomic aura[a] |
| Abdominal aura | • Psychic aura |
| Autonomic seizure[a] | |
| Dialeptic seizure[b] | |
| • Typical dialeptic seizure[b] | |
| Motor seizure[a] | |
| • Simple motor seizure[a] | |
| Myoclonic seizure[a] | Tonic seizure[a] |
| Epileptic spasm[a] | Clonic seizure[a] |
| Tonic-clonic seizure | Versive seizure[a] |
| • Complex motor seizure[b] | |
| Hypermotor seizure[b] | Gelastic seizure |
| Automotor seizure[b] | |
| Special seizure | |
| • Atonic seizure[a] | • Astatic seizure |
| • Hypomotor seizure[b] | • Akinetic seizure[a] |
| • Negative myoclonic seizures[a] | • Aphasic seizure[b] |
| Paroxysmal event | |

[a] Left/right/axial/generalized/bilateral asymmetric.
[b] Left hemisphere/right hemisphere.

## Auras

Auras consist exclusively of subjective symptoms and usually occur at the beginning of a seizure ("warning symptoms"). In general, they are brief (seconds) and only rarely may persist longer (minutes). They may oc-

cur in isolation from any other ictal symptom and, if so, tend to last slightly longer. In general, the epileptic nature of auralike symptomatology can be documented objectively only if the aura consistently evolves into a dialeptic or motor seizure or if EEG monitoring demonstrates an EEG seizure pattern during the aura.

In the SSC, auras are subdivided into the following subgroups:

a. Somatosensory auras. Somatosensory auras consist of abnormal somatosensory sensations ("paresthesias") that are limited to a clearly defined somatosensory region of the body. Sensations that are poorly localized or consist of vague sensations should be classified as unclassifiable auras (just "auras").
b. Visual auras. Visual hallucinations or illusions, when occurring in isolation, should be classified as visual auras. More elaborate visual hallucinations or illusions that are associated with other complex distortions of perception (such as alterations of the sense of familiarity of what the patient is seeing or hearing, complex visual or auditory illusions, or the hearing of voices, and so on), should be classified as visual auras only if the visual hallucination or illusion is clearly the predominant symptom, at least for a significant part of the aura. Otherwise, they should be classified as psychic auras (described below). Poorly defined alterations of vision (such as "blurry vision") should be designated unclassifiable auras.
c. Auditory auras. Isolated auditory hallucinations or illusions should be classified as auditory auras. More elaborated auditory hallucinations or illusions that occur together with complex alterations of perception (such as alterations of the sense of familiarity of what the patient is seeing or hearing, visual or auditory illusions, or the simultaneous occurrence of complex visual hallucinations, and so on) should be classified as auditory auras only if the auditory hallucination or illusion is clearly the predominant symptom. Otherwise, these complex auras should be classified as psychic auras (described below).
d. Olfactory auras. Perception of a smell as an epileptic phenomenon is classified as an olfactory aura. At times, like auditory and visual hallucinations and illusions, they are associated with other complex alterations of perception. These complex alterations of perception should be classified as psychic auras unless the olfactory aura is clearly the predominant feature.
e. Gustatory auras. Perception of a taste as an epileptic phenomenon is classified as a gustatory aura. These auras also tend to be associated with complex perceptual alterations. The term gustatory aura should be applied only when the gustatory hallucination is the predominant symptom.
f. Autonomic auras. Autonomic alterations elicited by epileptic activation of autonomic cortical centers produce symptoms that the patient can detect but that observers have difficulty identifying, particularly from a videotape recording (palpitations, hot flashes, and so on). Sensations that most probably are an expression of an epileptic autonomic alteration are classified as autonomic auras even when there is no objective proof of their autonomic pathogenesis (such as palpitations or hot flashes). In contrast, autonomic alterations appropriately documented by polygraphic recordings (tachycardia, blood pressure changes, and so on) or direct visual observation (mydriasis, sweating, flushing, piloerection, and so on) are classified as autonomic seizures (described below).
g. Abdominal auras. Patients with temporal lobe epilepsy frequently have auras with abdominal sensations. Some of these abdominal auras are most probably the expression of increased abdominal peristalsis and therefore correspond to a subgroup of autonomic auras (or autonomic seizures, if the alteration of peristalsis has been documented). In other cases, they may be an expression of activation of sensory cortical areas of the abdominal viscera. Independent of the pathogenesis, these abdominal auras are closely related to temporal lobe epilepsy; therefore, it appears useful to classify them independently as abdominal auras.
h. Psychic auras. Psychic auras consist of complex hallucinations and illusions that usually affect different senses. The most typical examples are distortions of familiarity, such as sensations of déjà vu or jamais vu. Frequently these sensations may be associated with emotional alterations, such as fear. In addition, they may occur together with complex visual, auditory or other hallucinations and illusions, including visual hallucinations such as macropsia, micropsia, and so on.

**Autonomic seizures**

Autonomic seizures consist of episodic alterations of autonomic function that are elicited by activation of autonomic cortical centers activated by an epileptiform discharge. Cases in which the patient reports only sensations that most probably correspond to an autonomic alteration (hot flashes, palpitations, and so on) and for which there is no objective documentation should be classified as autonomic auras (described above). To make the diagnosis of an autonomic seizure, episodes of autonomic dysfunction must be documented by appropriate polygraphic recording (tachycardia, blood pressure

changes, and so on) or by direct observation. Documented episodes of autonomic dysfunction may be clinically silent (i.e., the episodes may only be detected by a monitor, without the patient experiencing any unusual symptoms).

**Dialeptic seizures**

Dialeptic seizures is a new term coined to identify seizures in which the predominant symptomatology consists of an alteration of consciousness (see discussion of terminology above). Alteration of consciousness is difficult to define. However, for the purpose of identifying dialeptic seizures, we classify altered consciousness as does the ILAE classification of epileptic electroclinical complexes, e.g., as episodes of unresponsiveness or decreased responsiveness that are not caused by motor alterations. Dialeptic seizures are associated with complete or at least partial amnesia for the episode; therefore, amnesia of the episode is necessary to establish the diagnosis of dialeptic seizure.

Typical dialeptic seizures consist of short episodes of altered consciousness: <20 s. The alteration of consciousness begins and ends abruptly and frequently is associated with rhythmical eye blinking at a rate of ~3 Hz. Patients with generalized absence epilepsy often have typical dialeptic seizures. All seizures that consist mainly of an alteration of consciousness but that are not "typical dialeptic seizures" should be classified as just dialeptic seizures.

**Motor seizures**

Seizures in which the main symptomatology are motor signs are identified as motor seizures. Two major subgroups can be differentiated:

1. Simple motor seizures in which the motor movements are relatively "simple," unnatural, and consist of movements similar to movements elicited by electrical stimulation of the primary motor areas (Brodmann areas 4 and 6).
2. Complex motor seizures, in which the movements are relatively complex and simulate natural movements, except that they are inappropriate for the situation.

**Simple motor seizures**

Simple motor seizures can be subdivided into the following subgroups:

a. Myoclonic seizures. Myoclonic seizures consist of short muscle contractions lasting <400 ms.
b. Tonic seizures. Tonic seizures consist of sustained muscle contractions, usually lasting >3 s, that lead to "positioning."
c. Epileptic spasms. The term epileptic spasm is used to identify muscle contractions of variable duration which affect predominantly axial muscles. Epileptic spasms frequently occur in clusters in which the duration of the muscle contractions may vary from a short myoclonic jerk to a sustained tonic posturing. Usually the epileptic spasm consists of abduction of both arms in a "salaam" posture.
d. Clonic seizures. Clonic seizures are a series of myoclonic contractions that regularly recur at a rate of 0.2–5/s.
e. Tonic-clonic seizures. Generalized tonic-clonic seizures are characterized by an initial tonic posturing of all limbs. The sustained muscle contractions that determined the tonic phase then tend to slow, evolving into a clonic phase with contractions of progressively decreasing frequency until the contractions disappear completely. The muscles included in the tonic and clonic phase should be essentially the same. Focal motor seizures showing such a tonic-clonic evolution are infrequent.
f. Versive seizures. Versive seizures are seizures during which the patient either has a conjugate eye movement to one side or moves the head, and occasionally the whole body, to one side. Only conjugate eye movements or lateral head and body movements that are *sustained and extreme* should be classified as versive seizure. The lateral movement of the eyes frequently consists of a combination of a smooth tonic lateral movement on which are superimposed small saccades that progressively move the eye out to an extreme position. On other occasions, a smooth lateral movement without any saccades may be observed. The version of body parts has a similar character, but the saccades are replaced by small clonic lateral movements of the head or body. During these lateral movements, the chin frequently moves not only laterally but also upward, resulting in an *unnatural* position of the eyes and head. Occasionally, the patient's body will also turn and may complete one or more 360° turns.

**Complex motor seizures**

The following three types of complex motor seizures can be distinguished. Again, "complex" herein refers to the complex characteristics of the movement and does not mean that the patient loses awareness during the seizure.

a. Hypermotor seizures. Hypermotor seizures are seizures in which the main manifestations consist of complex movements involving the proximal segments of the limbs and trunk. This results in large movements that appear "violent" when they occur at high speeds. The "complex motor manifestations" imitate normal movements, but the movements are inappropriate for the situation and usually serve no purpose. Frequently, the movements

are stereotypically repeated in more or less complex sequences (e.g., pedaling). Consciousness may be preserved during these seizures.

b. Automotor seizures. Automotor seizures are complex motor seizures in which the main manifestations consist of automatisms involving the distal segments of the hands and feet or the mouth and tongue. Consciousness is usually affected but may be preserved, particularly when the seizure originates from the nondominant hemisphere.

c. Gelastic seizures. Seizures in which the main motor manifestation is "laughing" are termed gelastic seizures. They may be preceded or followed by any other type of seizure. Only seizures in which *the main ictal semiology* is laughing should be classified as gelastic seizures. These seizures are classified separately because they are common in patients with hypothalamic hamartoma.

**Special seizures**

Seizures that cannot be classified in one of the four types described above are classified as special seizures. All these seizures are "negative" or "inhibitory" motor seizures except the aphasic seizures that most probably represent "negative cognitive" seizures.

a. Atonic seizures. Atonic seizures cause a loss of postural tone. The result is loss of posture (head drops, falls, and so on). Often these seizures are preceded by a short myoclonic seizure.

b. Astatic seizures. Astatic seizures consist of epileptic falls. Polygraphic studies show that only in a few patients are the falls the result of atonic seizures. In most patients, a myoclonic jerk causes the patient to lose balance, and the fall itself is produced by an atonia that occurs immediately after the initial myoclonic jerk. Pure generalized tonic seizures may also lead to an epileptic fall. In most patients, however, no video-polygraphic studies are performed and the pathogenesis of the fall is uncertain. It seems useful to classify astatic seizures separately because of the variable pathogenesis of the falls, which usually remains undefined.

c. Hypomotor seizures. Hypomotor seizures have as their main manifestation a decrease or total absence of motor activity without the emergence of new motor manifestations. *This classification is used exclusively in patients in whom it is not possible to test consciousness during or after the seizure* (such as newborns, infants, and severely mentally retarded patients). In many patients, consciousness is probably altered during the seizures even if by definition consciousness cannot be tested directly. In a few patients with hypomotor seizures, the pathogenesis of the seizures may be different; consciousness may be preserved, and the absence of movement may be an expression of an akinetic seizure or may be a reaction to an aura.

d. Akinetic seizures. Akinetic seizures are characterized by the inability to perform voluntary movements. Therefore, they can actually be considered negative complex motor seizures. Muscle tone is also frequently lost, but the akinesia is the most prominent manifestation of the seizure. These seizures are most probably an expression of the activation of the negative motor areas in the mesial frontal and inferior frontal gyri. Only patients in whom consciousness is preserved during the seizures can have akinetic seizures because they can be tested or tell about the "akinetic" symptoms.

e. Negative myoclonic seizures. Negative myoclonic seizures are seizures that consist of a brief interruption of tonic muscle activity due to an epileptiform discharge. The brief interruption of muscle activity may result in a short, sudden movement similar to a myoclonic jerk. However, the pathogenesis of the movement is a brief loss of muscle tone and not a burst of muscle potentials characteristic of myoclonic seizures. Evidence suggests that these seizures are generated by epileptiform discharges in the primary sensorimotor cortex.

f. Aphasic seizures. During aphasic seizures, the patient cannot speak and often cannot understand spoken language. The seizures are probably a negative phenomenon produced by epileptic activation of a cortical language center, a phenomenon similar to that produced by cortical stimulation of language areas.

**Paroxysmal events**

Paroxysmal events are episodes in which the observer believes that there is not sufficient evidence to assume that a "seizurelike" event was of epileptic nature. If an "ictal" EEG is available, it should not show an ictal EEG pattern. This classification of epileptic seizures is based *exclusively on semiology.* However, the *EEG can be used to determine whether an episode is epileptic or not.* Episodes for which there is not sufficient proof of epileptic nature are classified merely as paroxysmal events. Otherwise, this semiological classification would have to be expanded to include the semiology of nonepileptic events, which may be extremely varied. Addressing nonepileptic events would require a different approach to classification.

**Somatotopic distribution of seizure semiology**

The clinical semiology of many seizures, particularly those in patients with focal epileptic syndromes, tends to have a somatotopic distribution. In the seizure classification, we use the following somatotopic modifiers (Table 2) to characterize the seizures better and thus define their origin more precisely:

**TABLE 2.** *Localizing and lateralizing modifiers for seizure types in a semiological classification*

| | |
|---|---|
| 1. | Left[a] |
| | Right[a] |
| | When the somatotype localization of the seizure is well defined it should also be specified (Example: left arm, right foot, and so on) |
| 2. | Axial[a] |
| | Bilateral asymmetric[a] |
| | Generalized[a] |
| 3. | Left hemispheric[b] |
| | Right hemispheric[b] |

[a] Seizure types marked with superscript *a* in Table 1, can be modified by the expression listed under 1 and 2 in Table 2.

[b] Seizure types marked with superscript *b* in Table 2, can be modified by the expression listed under 3. in Table 2.

a. Left or right. The terms left and right refer strictly to the somatotopic localization of the symptoms, not the brain region. They can be applied to all the seizures marked with superscript *a* in Table 1.
b. Somatotopic area involved. For seizures involving a distinct somatotopic region, the somatotopic area is specified by simply naming the region itself. These terms can be applied to all seizures marked with superscript *a* in Table 1. Examples:
   Left hand clonic seizure
   Throat somatosensory aura
   Left foot tonic seizure
c. Bilateral asymmetric, axial, and generalized. The terms bilateral asymmetric, axial, and generalized also refer strictly to the somatotopic localization of the clinical semiology. Bilateral asymmetric means that the symptoms occurred in a bilateral distribution but had a significant degree of asymmetry. The term suggests that the patient has a focal epilepsy. The modifier generalized is used when the manifestations occur in a relatively widespread distribution and there is approximately equal involvement of both sides and of the distal and proximal segments. The modifier "axial" is used when the manifestations involve predominantly the muscles of the trunk and the proximal muscles of the extremities. Usually patients who have axial or generalized seizures have generalized epilepsy. However, some patients with focal epilepsy may have axial or generalized seizures and, vice versa, patients with generalized epilepsies may have seizures that include significant focal elements. In other words, the relationship between clinical semiology and epileptic syndromes is not one to one. These modifiers can be applied to all the seizures identified with superscript *a* in Table 1.
d. Left and right hemispheric. Certain signs may identify the hemisphere of origin of a seizure. These signs include dystonic posturing during a complex motor seizure, preservation of consciousness during an automotor seizure, ictal speech during an automotor seizure, postictal aphasia, and so on. The presence of any of these signs strongly suggests the hemisphere of origin of a seizure. This localizing information is included in the classification by using the modifiers "left or right hemispheric." These modifiers can be used to describe the seizures marked by superscript *b* in Table 1. Example: A dialeptic seizure preceded by an abdominal aura and followed by post ictal aphasia should be classified (if the patient is left-hemisphere dominant for language) as abdominal aura → left hemispheric dialeptic seizure. An automotor seizure in which there is no loss of consciousness and which is associated with dystonic posturing of the left hand and arm should be classified as a right hemispheric automotor seizure.

### Status epilepticus

Essentially any of the seizure forms described above can manifest as status epilepticus. Status epilepticus is classified in the same way as the seizures by replacing the term "seizure" with "status"—e.g., dialeptic status, right foot clonic status.

### Seizure sequence

Most seizures consist of symptoms that evolve as the seizure discharge spreads to involve new cortical areas. In the semiological classification of seizures, this evolution is indicated by considering each one of the seizures described above as one component of a seizure. Any given seizure consists of one or more of these components, which are listed in order of appearance and are linked by arrows. Example:

Left visual aura → left hand clonic seizure → generalized tonic-clonic seizure
Left visual aura → bilateral asymmetric tonic seizure → left arm clonic seizure
Abdominal aura → left hemispheric automotor seizure
Olfactory aura → automotor seizure → left versive seizure → generalized tonic-clonic seizure
Generalized myoclonic seizure → generalized tonic-clonic seizure
Typical dialeptic seizure → generalized tonic-clonic seizure

Typically, we limit the number of seizure components to four for practical purposes.

### Epilepsy classification

The semiological seizure classification is a classification of the semiology of the seizures only. The epileptic syndrome, however, is defined by considering all clinical information (semiological seizure type, interictal EEG, ictal EEG, functional and anatomic neuroimaging, seizure evolution over time, neurological examination, and

so on). In our institutions, we first define the *epileptic syndrome,* then list the *semiological characteristics of the patient's seizures,* state the presumed *cause* of the epileptic syndrome, and record important additional *medical conditions* which the patient has. This approach summarizes the essential features of the epilepsy and has been described in detail elsewhere (6). Some illustrative examples follow.

1. Left Mesial Temporal Lobe Epilepsy
   - Seizures: Abdominal aura → automotor seizure
   - Cause: Left mesial temporal sclerosis
   - Related medical conditions: Febrile convulsions, Memory deficit, Cerebellar atrophy
2. Absence Epilepsy
   - Seizures: Typical dialeptic seizure → generalized tonic-clonic seizure
   - Cause: Genetic
   - Related medical conditions: None
3. Lennox-Gastaut syndrome
   - Seizures: Generalized tonic seizure, Dialeptic seizure, Astatic seizure
   - Cause: Tuberous sclerosis
   - Related medical conditions: Mental retardation, Depression
4. Right Frontal Epilepsy
   - Seizures: Asymmetric bilateral tonic seizure → Left arm clonic seizure → Generalized tonic-clonic seizure
   - Cause: Right mesial frontal cortical dysplasia
   - Related medical conditions: Schizophrenia, Mild mental retardation

## SUMMARY OF THE ESSENTIAL CHARACTERISTICS OF THE SEMIOLOGICAL CLASSIFICATION OF EPILEPTIC SEIZURES

The semiological seizure classification outlined above integrates the following features, which make it particularly useful for everyday application:

1. The terminology applied is as succinct as possible to facilitate everyday use.
2. Whenever available, "classical" terminology, well known to general neurologists and epileptologists, has been used.
3. The classification includes a few new terms, such as automotor, hypomotor, hypermotor, and dialeptic seizures. These new terms have been introduced to avoid confusion with other terms that identify similar seizures but that are defined not by pure semiological criteria but by electroclinical characteristics (see section Dialeptic seizures).
4. The semiological seizure classification includes "somatotopic modifiers" that permit definition of the somatotopic distribution of the ictal symptoms.
5. Each seizure type is considered a component. Different seizure evolutions are expressed by linking the different seizure types ("components") by an arrow. Types of seizure evolution are not limited arbitrarily. This classification system should permit scientific studies of the most frequent type of seizure evolutions.
6. Ictal symptoms frequently cannot be defined with precision because of inadequate information (for example, a patient may be amnestic of the seizure and there may be no witness to the seizure or a witness may provide an incomplete and inaccurate history). The semiological difference classification permits classification of seizures with different degrees of precision. For example, if we believe that the patient had an epileptic seizure, we classify it as "epileptic seizure." If the main manifestation was motor, we classify the seizure as a "motor seizure." If the main manifestation was motor, we classify the seizure as a "motor seizure." If the motor seizure affected the right arm but we do not know if it was a simple or complex motor seizure, we can classify it as "right arm motor seizure." If we know that the movements during the seizure were "simple" (see definition above), but we have difficulty in defining the subtype, we can classify the seizure as "right arm simple motor seizure." And finally, if by history or direct observation we can establish that the movement of the right arm was of clonic type, we can classify the seizure in its maximum degree of precision, namely as "right arm clonic seizure." In other words, from left to right in Table 1, progressively more precise information is provided about the ictal semiology.

## ADVANTAGES OF SEMIOLOGICAL SEIZURE CLASSIFICATION

Semiological classification of epileptic seizures has the following advantages:

1. It provides a terminology that permits clear identification of ictal semiological features independent of any other test results.
2. It clarifies the difference between seizure classification and epileptic syndrome classification. Many epileptic syndromes may be associated with the same types of seizures (when classified semiologi-

cally); therefore, appropriate management of the patient will require that the physician define the epileptic syndrome. For example, establishing that a patient has dialeptic seizures does not tell us whether the patient has generalized epileptic syndrome such as absence epilepsy, which can be treated with ethosuximide, or a focal epileptic syndrome, in which ethosuximide is ineffective.

3. A semiological seizure classification focuses the attention of the observer on clinical semiology.
4. A semiological seizure classification in which we do not assume a one-to-one relationship between clinical semiology and other test results promotes scientific correlation studies between the different types of seizures (classified exclusively on the basis of ictal semiology) and other test results. Such studies should eventually provide better understanding of the significance of different semiological features.
5. A semiological seizure classification, particularly if it is comprehensive, can be applied to any age group. However, certain types of seizures will not occur or will seldom occur in newborn and infants because of their incompletely developed nervous system.

## CONCLUSION

In this short outline, we introduce a semiological seizure classification. The present version—or variants of it—has been used in daily clinical practice for >10 years in selected epilepsy centers. The advantages of a semiological seizure classification are stressed.

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