Ictal Cognitive Assessment of Partial Seizures and Pseudoseizures

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Background: Previous studies suggest that responsiveness is impaired during complex partial seizures (CPS) and pseudoseizures (PS); however, to our knowledge, there has been no systematic comparison using both response and memory testing.

Objective: To compare CPS with PS using ictal cognitive assessment (ICA) of responsiveness and memory.

Patients and Methods: We used a nonautomated method of ICA by bedside observers, consisting of family members and staff, during video electroencephalographic monitoring to test responsiveness and memory during the ictal phase in 245 events. We assessed the adequacy of testing and compared the testing results in 31 patients during CPS and 13 patients during PS.

Results: The ictal presentation of a command was successful in 58% of the events. The ictal presentation of at least 2 memory items with testing for recall after orientation was adequate in 57% of events. Impaired responsiveness was shown during both CPS and PS. However, some response was detected during 48% of PS compared with 18% of CPS (P < .01). Memory items were recalled during 63% of PS but during only 4% of CPS (P < .001). The International Classification of Epileptic Seizures remained useful, but in 11 events (8%), distinguishing complex from simple partial seizures was difficult. Recall of various types of stimuli (aural-verbal vs visual-pictorial) during ICA did not correlate with the side or location of the seizure focus, but this may have been confounded by the rarity of any memory recall during CPS.

Conclusions: Ictal cognitive assessment by bedside observers is practical and provides the interaction necessary for properly classifying seizures; ICA, especially memory, may help to distinguish CPS from PS.

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**ICTAL COGNITIVE** assessment (ICA) is the interactive examination of memory and responsiveness during an epileptic or nonepileptic event. The unpredictability and short duration of most events complicate ictal testing. Consequently, most studies with ictal testing have been performed when seizures were either very frequent, as in absence seizures,¹ or prolonged, as in nonconvulsive status epilepticus.²,³ Nevertheless, ICA is an essential part of the clinical evaluation of partial seizures.⁴,⁵

Assessment may detect loss or impairment of consciousness and determine whether the event is a complex partial seizure (CPS) or a simple partial seizure (SPS). However, evaluation is frequently limited to passive observation without patient-observer interaction. Another aspect is memory, but memory stimuli are seldom well defined, and testing of recall is often incomplete. The terms loss or impairment of consciousness may inadequately describe what is actually a more complicated situation in which some behavioral capacities are lost, while others are retained.⁷ One could speculate that if differentially encodable (aural-verbal vs visual-pictorial) memory stimuli were presented during a CPS, recall of certain stimuli but not others might implicate seizure involvement in certain brain areas. To our knowledge, no such ictal memory study has been performed, but postictal recognition memory has been found to be useful for seizure focus lateralization.⁸ With ICA of pseudoseizures (PS), some authors⁹-¹¹ have noted unresponsiveness, but others¹²,¹³ have emphasized that unresponsiveness may be more apparent than real. However, there has been no systematic comparison between epileptic seizures and PS testing “apparent” responsiveness. For ictal memory, patients with PS but not epileptic seizure could recall by hypnosis some details of their events.¹⁴ In a study of patients with
PATIENTS AND METHODS

Patients with intractable seizure were monitored in private hospital rooms with portable video electroencephalographic (EEG) equipment (Telefactor, West Conshohocken, Pa). We taught family members and Epilepsy Center staff how to do ICA using role-play demonstrations, videotaped examples of testing, written instructions, and reinforcement after an initial attempt. Semitrained staff, including nurses and psychologists, received brief instruction either from a single in-service teaching session or from the Epilepsy Center staff. We encouraged the use of visually and aurally presented commands and memory items. The observers chose the specific memory items and commands. The observer might give a spoken command such as “shake my hand” and simultaneously extend his or her hand toward the patient, providing an additional cue for patients who may be distracted during an event or who may have an ictal or postictal verbal (propositional) language disturbance. The command was to be given immediately and was to be followed by 3 spoken memory items, such as “12 red roses.” The observer then showed the patient objects available at the bedside (eg, cup, fork, and pencil) to name and remember. Object presentation provided dually encodable stimuli that potentially could be placed into memory even in the presence of ictal or postictal verbal language dysfunction. After orientation by the observer, the patient was asked to recall the command and both the spoken and the visually presented memory items. If the patient failed free recall, cues were given.

We analyzed video EEG data on patients and observers monitored at Duke University Medical Center, Durham, NC, from January through December 1989. Episodes resulting from cardiac, movement, sleep, metabolic, and cerebrovascular disorders were excluded. Primary generalized seizures, tonic-clonic seizures without definite partial onset, and indeterminant and subjective episodes were also excluded. Using video EEG, determination was made as to whether commands were given ictally and whether memory testing was adequate. An impaired response was often used to mark the clinical seizure onset, and in these cases the memory adequately in at least 70% of attempts, and there was no significant difference between family members and trained staff members. Ictal commands were given successfully in 141 (58%) of the 245 events: 115 CPS, 5 SPS, and 21 PS. While testing was attempted in 16 SPS, ictal commands were given in only 5; we noted that when conversation could be maintained during an SPS, the observer often did not give a command. Memory testing was adequate in 139 events (57%): 102 CPS, 13 SPS, and 24 PS. We successfully tested responsiveness, memory, or both in 31 patients during CPS, 5 patients during SPS, and 13 patients during PS.

RESULTS

TESTING ADEQUACY

Observers were present in 245 (93%) of the 264 events: family members in 194 events, trained staff members in 41 events, and semitrained staff members in 10 events. Observers attempted testing in 191 (72%) of the 264 events. Family members attempted testing in 150 of the 194 events, a number that was significantly lower ($P<.01$, $X^2 = 7.70$) than that of the trained staff members, who attempted testing in all but 1 event. Semitrained staff members attempted testing in only 1 event (10%). If a family member or a trained staff member made an attempt, he or she successfully presented an ictal command or tested memory adequately in at least 70% of attempts, and there was no significant difference between family members and trained staff members. ictal commands were given successfully in 141 (58%) of the 245 events: 115 CPS, 5 SPS, and 21 PS. While testing was attempted in 16 SPS, ictal commands were given in only 5; we noted that when conversation could be maintained during an SPS, the observer often did not give a command. Memory testing was adequate in 139 events (57%): 102 CPS, 13 SPS, and 24 PS.

DISTINGUISHING CPS FROM SPS

The classification of 11 events (8% of properly tested partial seizures) in 6 patients was problematic. The events were finally classified into 4 SPS and 7 CPS. We describe 2 patients with partial seizures that were difficult to classify.
Patient 1, a 30-year-old woman, had seizures consisting of staring with oral automatisms and impaired responsiveness. However, she claimed that she remained aware and when driving could “concentrate and drive straight ahead” without difficulty. During scalp video EEG monitoring, she conversed with her husband during several events, although her responses were slow. She followed commands during several seizures but never recalled the commands later. Although she repeated aurally presented verbal items and named visually presented objects, she had no memory recall except of some objects that were presented near the end of her seizures. As the patient remained conversant and responsive to commands, failure of recall could not be attributed to aphasia. An EEG showed rhythmic theta and delta activity over the left temporal area, with spread to the entire left hemisphere and partially to the right hemisphere.

Patient 2, a 24-year-old woman, had seizures associated with lip smacking and swallowing. During scalp video EEG monitoring, she responded with aphasic speech when tested during the events. She could carry out some complex and purposeful actions during the ictal phase but did not follow commands. The failure to follow commands was attributed initially to ictal aphasia, but she did not recall the speech deficit, even when the seizure was brief. During 1 seizure, she also recalled some visually presented objects, but was generally amnestic for objects and verbal items. The EEG showed rhythmic delta and theta activity over the left temporal region, spreading to the left anterior quadrant, with some late reactivity (Table 1). No definite pattern emerged, but during 5 seizures the responses occurred within 10 seconds of clinical seizure onset. The 2 patients described above with left temporal foci had 3 of the 4 CPS during the study with retained recall. Recall of some visually presented objects is of interest, as both patients had left temporal seizure foci. The third patient with retained recall had a left frontal focus (Table 2). However, with only 4 CPS with retained recall, no definite correlation could be made between the type of recalled stimuli and lateralization or localization of the seizure focus.

### DISTINGUISHING PARTIAL SEIZURES FROM PS

Distinguishing a CPS from a PS was not difficult in our patients because there were prominent ictal behavioral differences and because the CPS was usually associated with an EEG correlate. We are aware that distinguishing frontal lobe and other extratemporal seizures from PS is sometimes difficult owing to similarities in ictal semiology and their potential lack of an EEG correlate. We recently documented a case involving seizures of extratemporal origin in which a patient with generalized tonic-clonic movements was initially thought to have PS because of retained responsiveness and memory. Some of our patients had brief seizures of presumed extratemporal origin with minimal EEG changes, but they also had ictal and interictal features that suggested true epileptic seizures. Pseudoseizures can mimic SPS, and SPS may not have an ictal EEG correlate. However, in all but 1 of the patients with PS in our study, the PS were characterized by an apparent alteration in consciousness or bilateral motor movements, making confusion with SPS unlikely. The 1 responsive patient with PS moaned, grimaced, and had apparent oral automatisms, features that mimicked CPS.

### COMPARING CPS AND PS

The age ($P = .14$, t test) and sex ($P = .90$, $\chi^2 = 0.015$) differences between the CPS group and the PS group were not significant. The mean ± SD number of adequately presented memory items during a CPS (4.8 ± 1.2) was simi-

### Table 1. Response Testing During Complex Partial Seizures and Pseudoseizures

<table>
<thead>
<tr>
<th></th>
<th>Complex Partial Seizures</th>
<th>Pseudoseizures</th>
<th>$\chi^2$</th>
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<tbody>
<tr>
<td>Total (seizures)</td>
<td>115 (98)</td>
<td>21</td>
<td>.95</td>
</tr>
<tr>
<td>Impaired response</td>
<td>113 (98)</td>
<td>20 (95)</td>
<td>.95</td>
</tr>
<tr>
<td>Any response</td>
<td>21 (18)</td>
<td>10 (48)</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>Total (patients)</td>
<td>31</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Impaired response</td>
<td>31 (100)</td>
<td>12 (92)</td>
<td>.65</td>
</tr>
<tr>
<td>during any event</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any response during</td>
<td>10 (32)</td>
<td>7 (54)</td>
<td>.32</td>
</tr>
<tr>
<td>any event</td>
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### Table 2. Memory Testing During Complex Partial Seizures and Pseudoseizures

<table>
<thead>
<tr>
<th></th>
<th>Complex Partial Seizures</th>
<th>Pseudoseizures</th>
<th>$\chi^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (seizures)</td>
<td>102</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>Any memory recall</td>
<td>4 (4)</td>
<td>15 (63)</td>
<td>&lt;.001†</td>
</tr>
<tr>
<td>Memory recall ≥50%</td>
<td>0</td>
<td>13 (54)</td>
<td>&lt;.001†</td>
</tr>
<tr>
<td>Total (patients)</td>
<td>31</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Any memory recall</td>
<td>3 (10)</td>
<td>10 (77)</td>
<td>&lt;.001†</td>
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<tr>
<td>during any event</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory recall ≥50%</td>
<td>0</td>
<td>8 (62)</td>
<td>&lt;.001†</td>
</tr>
<tr>
<td>during any event</td>
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</table>

*$\chi^2$. †Fisher exact test.
l ar (P = .51, t test) to the number presented during a PS (4.7 ± 1.7).

Impaired responsiveness was shown during more than 95% of both CPS and PS, but some responsiveness was noted significantly more often (P < .01, χ² = 7.11) during PS (48%) than during CPS (18%). However, response testing failed to distinguish between the patient groups (Table 1). We found greater differences in memory testing with recall during 63% of PS but during only 4% of CPS (P < .001, χ² = 47.59). During 54% of the PS, there was greater than 50% recall of memory items but during none of the CPS did recall reach 50% (P < .001, χ² = 55.89). In our study, patients with memory recall of 50% or greater during any event had PS (P < .001, Fisher exact test) (Table 2).

Ictal cognitive assessment by bedside observers, whether family or staff, is practical and generally successful. Using family observers has advantages. They can distinguish typical from atypical events and recognize events that escape detection by staff members, who may be less familiar with the patient's spells.

Except for a few patients, distinguishing CPS from SPS using the International Classification was not difficult. As the classification depends on the presence of responsiveness and memory, ICA may increase the number of events that can be definitely classified. In video EEG monitoring, distinguishing between CPS and SPS may determine whether to expect an ictal EEG correlate. Complex partial seizures have an EEG correlate in 90% to 95% of cases, whereas SPS have an EEG correlate in about 20%. It would follow that an unresponsive patient without an ictal EEG correlate should raise suspicion for PS.

During video EEG evaluation of CPS, recall of differentially encodable memory stimuli did not correlate with seizure focus lateralization or localization, but few patients with CPS recalled stimuli of any kind. A larger series might reveal a few patients where differentially encodable stimuli provide lateralizing or localizing data, but the rarity of recall in our series would suggest low utility using ICA alone in pinpointing a seizure focus. However, by determining the beginning of altered responsiveness or amnesia, ICA may help to determine the time of clinical seizure onset. Comparing the time of clinical onset with the time of EEG onset is important for lateralizing a seizure focus.

Responsiveness is more common in patients with PS than in those with CPS, but response testing alone does not differentiate patients with CPS from those with PS. Memory testing helped us differentiate epileptic seizures from PS with 50% or greater recall in more than half the PS but never during any CPS. Any patient with recall of 50% or greater during an event with apparent alteration of consciousness should be suspected of having PS. However, as both patients with PS and patients with CPS may have an apparent loss of responsiveness and memory, other electroclinical features remain important for diagnosis.

We have shown the value of ICA, particularly memory, in distinguishing CPS from PS. While ICA alone does not appear to provide lateralizing or localizing data in partial seizures, other studies suggest that incorporating postictal language testing may provide lateralizing information when one is trying to pinpoint a seizure focus. Ictal cognitive assessment provides the necessary interaction between patient and observers for optimal use of the International Classification. As there is usually a luxury of time following a seizure, combining ICA with postictal language testing should provide maximal information.

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REFERENCES