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Awareness, overestimation, and underestimation of cognitive functions in epilepsy

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ABSTRACT

This study estimated cognitive awareness and the predictors of self-rating in patients with epilepsy (PWE). The Multiple Ability Self-Report Questionnaire (MASQ), State–Trait Anxiety Inventory, and Beck Depression Inventory were used for self-evaluation. Neuropsychological assessment yielded five single-domain scores (Long-Term Memory, Mental Speed, Working Memory, Set Shifting, and Visuospatial Matching) and a total composite score. Awareness was computed as the concordance between the neuropsychological and MASQ scores. In 37 patients with full awareness, self-ratings were predicted by Long-Term Memory, Working Memory, and Mental Speed. In 58 patients with incomplete or no awareness, self-ratings related to depression and seizure frequency. Compared with overestimation, underestimation was associated with higher test scores, better education, and younger age. Brain lesion and the type of epilepsy showed no effect. Therefore, PWE may appear unaware of their cognitive abilities due to negative affect and clinical burden. Understanding patients' awareness of their cognitive deficits can help clarify the clinical pattern provoked by epilepsy, as well as patients' compliance with treatment for seizures or cognitive difficulties.

1. Introduction

Although anosognosia of motor deficits was recognized by Babinski in 1914 [1], for decades, the denial of cognitive deficits by some neurological patients was attributed by many clinicians to psychiatric factors. The definition and measurement of cognitive awareness have been beset by conceptual and methodological problems. Anderson and Tranel [2] operationally defined awareness of cognitive impairment as the concordance between the patients' self-report and their performance in neuropsychological tests, while Prigatano and Altman [3] defined the awareness of cognitive and behavioral problems as the concordance between patients' self-ratings and relatives' ratings on the same scale. Two groups of theories tried to explain the unawareness of disease. The motivational theories considered anosognosia as a defensive adaptation of the patient to the disease [4]. The cognitive theories [5] defined anosognosia as a specific cognitive deficit consequent to the damage of particular brain regions. In patients with cerebral infarction, head trauma, or dementia, Anderson and Tranel [2] found an association between unawareness and right hemisphere damage, and McGlynn and Kaszniak [6] showed that unawareness increased with the severity of dementia, suggesting that anosognosia was related to cognitive impairment. The cognitive explanations of unawareness were attributed to deficits of body schema, memory, and executive functions [7,8]. Overestimation of cognitive efficiency was associated with right hemisphere frontoparietal damage, in line with the role played by the frontoparietal cortex in the integration of cognitive and affective information involved in self-awareness [9].

It is well recognized that patients with epilepsy (PWE) may be affected by cognitive deficits, often regarding memory, executive functions, and attention, due to the interference of epileptic discharges on cortical functions, brain lesions, antiepileptic drug (AED) therapy, or surgery [10–18] and that cognitive self-efficacy relates to difficulties in family, work, and social activities [19–21]. However, the nature and clinical implications of cognitive deficits are not always clarified by neuropsychological testing [22–26]. Neuropsychological assessment, using standardized, psychometrically valid and reliable procedures, gives operator-oriented measures but does not reproduce real life situations. Self-evaluation provides subjective measures, which may reflect not only everyday efficiency but also patients' affect [27]. Use of self-evaluation instruments started a few decades ago aiming to complement neuropsychological results [27–29], but most studies only explored perceived memory abilities, showing that subjectively impaired patients often obtained average or high scores in laboratory tests [27–30,32–37]. Seidenberg et al. [38] developed the Multiple Ability Self-Report Questionnaire (MASQ), which explores five cognitive domains. In 118 healthy subjects, the MASQ proved to be reliable (Chronbach's alpha = 0.92), fairly sensitive to age and education, and to correlate well with Wechsler Adult Intelligence Scale—Revised and Wechsler Memory Scale—Revised subtest scores; furthermore, the questionnaire was sensitive in discriminating patients with temporal lobe epilepsy (TLE) and healthy subjects [38]. Hermann et al. [31] replicated the correlation of the MASQ scores with test scores in patients submitted to TLE surgery not affected by depression, while

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Martin et al. [39] demonstrated that the total MASQ score related to post-surgical memory performance. By contrast, Sawrie et al. [40] and Baños et al. [41] found no correlation between the MASQ scores and neuropsychological performances, suggesting that self-reports reflected mood.

Discrepancies in the relationship between perceived and objective cognitive deficits and underlying factors affecting self-ratings may reflect differences in the level of awareness. It is possible that knowing patients' awareness of their cognitive deficits may help in understanding the clinical picture as well as patients' compliance with treatment for seizures or cognitive difficulties. Despite a variety of data concerning patients' complaints, our understanding of the awareness of cognitive abilities in PWE remains incomplete. To help fill this gap, this retrospective study compared the neuropsychological performances and self-ratings of adult PWE, investigating the frequency and types of unawareness and the determinants of self-rating in aware and unaware patients.

2. Methods

2.1. Patients

From 1998 to 2002, we compiled a series of self-evaluation questionnaires for 95 out of 214 adult PWE tested for clinical purposes. These 95 patients who completed the questionnaires were chosen randomly. They were older than 14 years, had five or more years of schooling, reported a disease duration longer than one year, showed no intellectual disturbances (as expressed by regular schooling accomplishments), or psychopathological symptoms (as expressed by clinical history and neurological examination). Magnetic resonance imaging or computerized tomography revealed the presence of focal brain lesions compatible with low-grade glioma, ganglioglioma, cavernous angioma, hippocampal sclerosis, neuronal migration disorders, or post-traumatic atrophy in 50 patients. Sixty-two patients were receiving treatment with carbamazepine, phenobarbital, phenytoin, or vigabatrin, while the others were receiving a combination of two to four drugs. In all patients, the AED plasma levels were in the normal ranges with no objective side effects. Table 1 summarizes patients' features. Sixty-six healthy subjects (mean age 49 ± 15.06 and mean schooling 12.95 ± 3.36) also completed the self-evaluation inventories.

2.2. Cognitive self-evaluation

The MASQ [38] comprises 38 questions that explore everyday performance in five domains: language, visual–perceptual abilities, verbal and visual memory, and attention/concentration. Each subscale contains eight questions except the visual–perceptual ability subscale which contains six. One to five points are attributed to each answer in relation to the frequency (almost never, seldom, sometimes, often, and almost always) of specific difficulties. The total score (38–190) is the sum of all subscale scores and gives an index of perceived functioning: the higher the total score, the more severe the perceived impairment.

Table 1
Demographic and clinical aspects of PWE.

Males	53	
Females	42	
Age	36.28 ± 12.32	(14–70)
Education (years)	10.73 ± 3.43	(5–18)
Age of seizure onset (years)	18.63 ± 13.30	(1–66)
Disease duration (years)	17.53 ± 11.20	(1–50)
Monthly seizure frequency	6.65 ± 9.43	(1–40)
Symptomatic epilepsy	50	
Temporal lobe epilepsy	36	
Frontal lobe epilepsy	29	
Parietal–occipital epilepsy	12	
Multifocal epilepsy	18	
One-drug therapy	62	

PWE, patients with epilepsy.

2.3. Depression and anxiety self-evaluation

The State–Trait Anxiety Inventory (STAI 1-2) [42] and Beck Depression Inventory (BDI) [43] assess anxiety and depression. Each scale gives a score (STAI: 20–80 and BDI: 0–39) that is proportional to the level of anxiety and depression, respectively.

The self-evaluation questionnaires were completed either in hospital (59 patients) or at home (36 patients).

2.4. Neuropsychological assessment

The neuropsychological battery consisted of tests for abstract reasoning (Raven's Colored Progressive Matrices, RCPM) [44], selective attention (Attentive Matrices) [45], visual perception (Recognition of Unknown Faces) [46], constructive praxis (Rey's Complex Figure, RCF, Copying) [47], comprehension (Token Test) [48], verbal immediate memory (Two-syllable Word Span score computed from the first trial of the Verbal Selective Reminding Procedure, SRP), verbal learning (Two-syllable Word Stable Recall score computed from performance across all of the Verbal SRP trials) [49,50], verbal long-term memory (Short Story) [51], verbal memory after interference (Verbal Distraction Test) [13,52,53], visual immediate memory (Design Span score computed from the first trial of the Visual SRP), visual learning (Design Stable Recall score computed from performance across all of the Visual SRP) [49,54], visual long-term memory (RCF Recall) [47], visual memory after interference (Visual Distraction Test) [52,53], set shifting (Wisconsin Card Sorting Test, WCST) [55], verbal initiative and lexical competence (Word Fluency, WF, on phonemic and semantic cues) [56], and conceptual–motor tracking and divided attention (Trail Making Test, TMT, A and B) [47,57].

2.5. Data analysis

The neuropsychological test, STAI, and BDI scores were reduced using factor analysis; factor loadings were attributed to one factor if greater than 0.5. All of the test raw scores were transformed into standardized z scores and the arithmetic means of the z scores pertaining to each factor provided single-domain composite scores. A total composite score (arithmetic mean of single-domain composite scores) was classified into four ranks of performance (quite impaired, poor, fair, and good). The MASQ total scores were classified into four ranks (quite altered, poor, fair, and good). According to Anderson and Tranel [1], awareness was computed as the level of concordance between the MASQ total score and total composite test score, distinguishing four levels: full (no discrepancy between self-rating and test performance), fair (one-level discrepancy between self-rating and test performance, for instance, MASQ quite altered rank and performance poor rank), scarce (two-level discrepancy, for instance, MASQ poor rank and performance good rank), and no awareness (maximum discrepancy, for instance MASQ good rank and performance quite impaired rank). Unawareness was divided into overestimation and underestimation. Separate hierarchical stepwise regression analyses, including the demographic variables (age, schooling, and gender), epilepsy-related variables (type of epilepsy, age of onset, duration, seizure frequency, number of AEDs, and presence of brain lesion), affective states (anxiety and depression), and the composite test scores, were used to assess the predictors of self-rating in patients with full or incomplete awareness. Post-hoc Pearson's product moment coefficient was used to evaluate single correlations.