Meta-Cognitive Ability and Brain Damage in Autoimmune Encephalitis: A Case Report

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SUMMARY

Autoimmune encephalitis is an important contributor to rapidly progressive cognitive and behavioral decline. The purpose of this work was to evaluate the effects of cognitive rehabilitation in a patient with autoimmune encephalitis. We also wanted to evaluate the effectiveness of rehabilitative treatment by monitoring the cognitive and meta-cognitive outcomes over a time interval.

We reported a case of 22 year-old female patient with autoimmune encephalitis, cognitive behavioral impairments, and severe reduction in meta-representational capacity. We performed an assessment of personality, neuropsychological, and meta-cognitive functions at the beginning of the rehabilitative training. The last evaluation was performed six months after the discharge from the rehabilitation unit. We applied a combination of remediation, psycho-educational treatment, and psychotherapy to improve the knowledge and the empathy of the patient, to promote the self-control strategies, and to prompt better behavioral management. Our findings revealed an improvement in the performance of the individual tests after rehabilitative training.

Keywords: autoimmune encephalitis, brain injury, cognitive rehabilitation, metacognitive deficit

INTRODUCTION

Autoimmune encephalitis is a heterogeneous group of disorders most likely resulting from a reaction of the immune system against antigens of the Central Nervous System (CNS). Some sub-acute encephalopathies are caused by autoimmune or inflammatory mechanisms, which are recognized by an association with auto-antibody markers and/or a clear response to immune-modulatory treatment (Dodd et al, 2015; Lewis & Glaser, 2005). Mortality rates are high and many of those that survive are affected by different brain impairments, including in-motor or cognitive functions (Singh et al., 2015). In more than half of all cases of encephalitis, the root cause remains unknown (Venkatesan & Benavides, 2015). Subjects may present with flu-like symptoms, severe headache, nausea, vomiting, altered consciousness, and seizures. After encephalitis, the neuronal damage may be focal, multi-focal, or diffuse. Autoimmune encephalitis results in rapidly progressive cognitive and behavioral decline (Chiou et al, 2011; Cella et al, 2012). An alteration in mental status is one of the main symptoms of encephalopathy. It is characterized by memory loss, personality changes, depression, and decreased problem-solving ability (Kayser & Dalmau, 2011). The meta-cognition is a higher-order thinking that enables understanding, analysis, and control of one's cognitive processes, especially when engaged in learning (Lou et al., 2016). The aim of this work was to assess, in a case of autoimmune encephalitis, the relation between the existence of specific organic damage and the presence of meta-cognitive deficits (thinking about one's own mental processes). We wanted to evaluate the effectiveness of rehabilitative treatment by monitoring the cognitive and meta-cognitive outcomes over a time interval.

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CASE REPORT

A 22-year-old female patient with autoimmune encephalitis presented with a severe impairment in cognitive function and focal neurological deficits. In May 2014, the patient was admitted to the emergency department because of frequent episodes of loss of consciousness and psychomotor retardation with a visible slowing of physical and emotional reactions, which included speech and affect. Memory loss, lack of interest, emotional blunting, and depression were also evident. The patient displayed behavioral disorders, generalized rigidity, and urinary incontinence. In addition, the patient had frequent episodes of crying along with spasticity, lockjaw, opsoclonus, and tetraplagia with spastic hypertonia. She experienced episodes of cutaneous flushing, hematuria, and high fever. A brain Computed Tomography (CT) examination revealed a large hypo-dense area in the right frontal region associated with intense peri-lesional edema. A Magnetic Resonance Imaging (MRI) of the brain highlighted several hyper-intense lesions in bilateral fronto-parietal areas (see Figure 1).

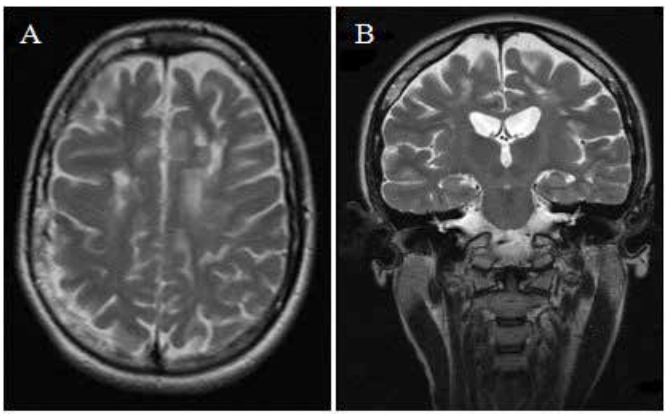

Figure 1. Axial (A) and Coronal (B) T2-weighted images revealed bilateral fronto-parietal lesions.

Table 1. Neuropsychological and Psychological assessment. Total score of neuropsychological and psychological assessment before and during rehabilitative training. T0 (baseline); T1 (2 months after T0); T2 (4 months after T0); T3 (6 months after T0).

Test	T0	T1	T2	T3	Cut-Off
Digit Span	2	3	4	5	5
Immediate recall prose memory	3	7	9	10	10
Delayed recall prose memory	6	8	10	11	11
Brown Peterson technique 10 sec.	4	4	5	5	5
Brown Peterson technique 30 sec	4	4	5	5	5
Trailmaking test-A	75	60	48	50	46
Trailmaking test-B	200	180	160	150	149
Token Test	3	4	5	5	5
Word Phonemic Fluency	5	6	9	9	9
Cognitive Estimation test	2	3	4	4	4
Intricate figures test	2	3	3	4	4
House figure copy	6	12	31	31	31
Daisy drawing test,	0	1	2	2	2
Spontaneous drawing	0	1	2	2	2
Clock Drawing test	2	4	9	9	9
Ideomotor apraxia test	3	3	6	6	6
Total score	28	44	64	66	72
Beck Depression Inventory	29	14	10	10	>13
Hamilton Anxiety Rating Scale	24	20	14	10	>17
Toronto Alexithymia Scale	76	68	50	45	>51
Symptom Checklist-90	-	80	90	90	
Rating Insight	2	2	2	2	

Cerebrospinal fluid examination was normal (proteins 25mg/dl, albumin 60%, IgG 15 mg/L, IsA0.1mg/l, IgM 0.3mg/L, oligoclonal bands absent). Serum anti-NMDA-receptors were positive, and a diagnosis of autoimmune encephalitis based on the conventional neurological evaluation and standard diagnostic tests (MRI data and CSF values) was made. At discharge, the patient appeared alert although, uncooperative and disoriented. Her speech was fluent but not comprehensible and inappropriate to the context. She displayed mood lability, and was generally euphoric with unmotivated laughter. She was apathetic and distractible, and the abulia and loss of insight were observed. In August, the patient was admitted to our Center for neuro-cognitive and neuro-motor rehabilitative treatment. We performed an assessment of personality, neuropsychological, and meta-cognitive functions at the beginning of the rehabilitative training (T0) by the end of first and second months (T1 – T2). The last evaluation was performed six months after discharge from the rehabilitative unit (T3). The neuropsychological assessment was performed with Brief Neuropsychological Examination (ENB-2) (Mondini et al. 2003) (see Table 1).

We applied: a) the Beck Depression Inventory (BDI) (Ghisi et al., 2006); b) Hamilton Anxiety Rating Scale (HAM-A) (Hamilton, 1959) to evaluate mood status; c) Toronto Alexithymia Scale (TAS-20) to assess alexithymia and meta-cognitive functions; and d) Clinical Insight Rating scale (CIR) to evaluate a broader spectrum of insight (see Table1) (Ott. et al, 2006). In particular, we applied TAS-20 to measure the introspective deficit of the patient (Caretti et al. 2011).

The patient underwent to rehabilitative intervention, and the cognitive rehabilitation program was performed for a period of 4 months, 2 times/week for a total of 24 sessions. Each rehabilitation session was divided into two different phases in the same day. In particular, we used a combination of cognitive rehabilitative training, psycho-educational interventions, and psychotherapy.

Cognitive rehabilitation (lasting 50 minutes) was focused on space-time orientation, attention, and memory exercises. We used techniques such as reality orientation therapy, attention training, vocal exercises, or paper-pen. We also used internal and external aids as clock, city maps (for spatial orientation), diaries, notebooks, and calendars. Psychotherapeutic treatment was aimed to improve the patient's problem-solving

skills, self-perception, and the ability of emotional and behavioral self-regulation. The scores obtained after rehabilitation training (comparison T0-T3) and revealed an improvement in the performance of the individual tests (see table 1).

Psychological evaluation highlighted a decrease in test scores corresponding to clinical improvement. The assessment of insight has not shown significant improvement by the patient. Therapy with Duloxetine 60mg/day, associated with psychotherapy, resulted in an improvement of depressive symptoms.

DISCUSSION

Metacognition is a spectrum of mental activities that involves the ability of thinking and allows inference of other persons' mental states and emotions (Bartynsky et al. 2006).

Metacognition and awareness are often considered global phenomena linked to anterior cingulate cortex, superior temporal sulcus, and temporal poles (Shimamura, 2000). Indeed, previous studies have established a function of anterior prefrontal cortex in metacognitive judgments of perceptual processes. An important role is played also by the inhibitory and regulatory function of the frontal lobe that allows the subject to preserve the intent and awareness of their own actions. As claimed by other authors, it is unknown whether metacognition is a global phenomenon with anterior prefrontal cortex supporting metacognition across domains, or whether it relies on domain-specific neural substrates (Fleming et al. 2014; Halperin, 2010).

Impairments in metacognition, a sophisticated mental ability, are observed in numerous clinical syndromes (Dewar & Williams, 2007; Young, 2007). Our patient showed a severe alteration of the fronto-cortical functions, including deficits of the meta-cognitive skills and reduced ability to control, direct, and coordinate all the cognitive activity. MRI, in fact, revealed lesions located in the frontal and temporal areas. Rehabilitative training aimed: a) to recover the patient's awareness of the consequences of her actions; and b) to improve her listening skills and her communication ability. The aim of neurocognitive rehabilitation was also to promote a metacognitive processing in order to articulate motivational and cognitive processes. We observed an improvement in cognitive performance of the patient (especially, in attention, executive functioning, and mood). We think that the treatment facilitated the recovery through exercises for the most affected functions.

This work, even if limited to a single case, highlighted that autoimmune encephalitis could cause a deficit in cognitive function and probably has a significant impact on the metacognitive ability. As revealed by previous studies (Arnold & Prike, 2015), the rehabilitative integrated training promotes the recovery of metacognitive skills. In addition, the patient reports a recovery at the end of the training performance. In the course of therapy, her mood status improved and alexithymia scale scores were decreased. Her status in relation to emotions, awareness, and behavioral control was improved. We hypothesize that the integrated treatment of drug therapy and psychotherapy might change the brain structures and functions through mechanisms of plasticity.

Neurocognitive deficits may be improved with psychological interventions and the effects of such interventions are not exclusively confined to the cognitive area (Raschilas et al, 2002; Moorthi et al, 1999). Indeed, numerous studies have revealed that rehabilitation facilitates recovery of the subjects in important areas of life such as work, social skills, and self-esteem. Other studies in this area may enhance our knowledge of metacognitive processes in subjects with brain damage, and provide awareness for clinicians for the effective use of techniques and tools for the assessment and treatment of these particular cognitive deficits.

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