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Neuropsychological dysfunctions in personality borderline disorder: detection strategies

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Introduction. Borderline personality disorder (BPD) is characterized by emotional instability and impulsivity. However, there is evidence that neurocognitive alterations have a relevant role in the clinical features of these patients. The present study investigates cognitive function in BPD in order to search for a specific profile of neuropsychological alterations.

Methods. Based on previous research and cognitive complaints reported by patients, a neuropsychological assessment protocol focused on prefrontal functioning was applied. The applied neuropsychological battery included tests assessing the following cognitive domains: memory (fixation, consolidation and recovery processes) categorical evocation, cognitive flexibility, sustained attention, processing rate, inhibitory control and working memory.

The patient sample was recruited from an outpatient BPD unit and was composed by 26 patients (14 women, 12 men) diagnosed of BPD.

Results. In comparison to the normative values, BPD patients have a deficit in the execution of most of the neuropsychological tests. This deficit was especially present in the following: recovery processes of the immediate and differed memory, working memory, sustained attention and processing rate, verbal fluency, impulse control, cognitive flexibility, abstraction and planning.

Conclusions. BPD patients could present a pattern of neurocognitive alterations that suggests a specific impairment of the prefrontal areas and requires a more detailed study. The neuropsychological dysfunctions could partially explain the behavioral alterations in BPD patients.

Key words:
Borderline personality disorder. Neuropsychological alterations.

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Alteraciones neuropsicológicas en el trastorno límite de la personalidad: estrategias de detección

Introducción. Los síntomas más característicos del trastorno límite o «borderline» de la personalidad (TLP) son la inestabilidad afectiva y la impulsividad. No obstante, existen indicios de que las alteraciones neurocognitivas podrían tener un papel relevante en la clínica de estos trastornos. El objetivo del presente estudio es investigar la función cognitiva en el TLP y buscar un patrón específico de alteraciones neuropsicológicas.

Metodología. Sobre la base de investigaciones anteriores y de las quejas cognitivas referidas por los pacientes, se ha aplicado un protocolo de evaluación neuropsicológica centrado en las funciones prefrontales. La batería neuropsicológica aplicada estaba compuesta por diferentes pruebas que evalúan los siguientes dominios cognitivos: memoria (procesos de fijación, consolidación y de recuperación), evocación categorial, flexibilidad cognitiva, atención sostenida, velocidad de procesamiento, control de inhibición y memoria de trabajo. Se han evaluado 26 pacientes diagnosticados de TLP, de los cuales 14 eran mujeres y 12 hombres, todos ellos pertenecientes al Servicio de Psiquiatría del Hospital Clínico San Carlos.

Resultados. En comparación con los valores normativos, los pacientes con TLP presentan un déficit en la ejecución de la mayoría de las pruebas neuropsicológicas utilizadas, especialmente en los procesos de recuperación de memoria inmediata y diferida, memoria de trabajo, atención sostenida y velocidad de procesamiento, fluidez verbal, control de impulsos, flexibilidad cognitiva, abstracción y planificación.

Conclusiones. El TLP podría presentar un patrón de alteraciones neurocognitivas que sugiere una afectación específica de áreas prefrontales y que precisa ser estudiado con mayor detalle. Las disfunciones neuropsicológicas podrían explicar parcialmente las alteraciones conductuales de estos pacientes.

Palabras clave:
Trastorno límite o «borderline» de la personalidad. Alteraciones neuropsicológicas.

INTRODUCTION

Borderline personality disorder (BPD) is a serious disease characterized by intense affective instability, serious impulsive behaviors, self injury and severe dysfunction of interpersonal relationships (American Psychiatric Association, 2000), that affects approximately 2% of the general population and causes severe functional limitation in many patients. It is much more frequent among the psychiatric population, in which a prevalence of up to 10% has been described.¹ Furthermore, many more cases of BPD are observed in women than in men (70% women versus 30% men).

Research on BPD has focused its attention on behavioral components of the syndromes such as: impulse acts, stormy interpersonal relationships and self-aggressions: Neurocognitive traits, which are equally important, have been overlooked for a long time. However, in recent years, their involvement in the development of the disorder is being studied in depth. In fact, in 1991, a study was conducted that related the risk of suicide in BPD with cognitive functioning, and not with depression levels.² It is important to know the neuropsychological characteristics of these patients for the diagnosis, estimation of suicide risk, treatment planning and prognosis.

In the last two decades, some neuropsychological factors have been taken into account in the development of BPD in different studies.^{3,4} Furthermore, different investigations have been developed that manifest the neurological and neuropsychological differences between patients with BPD and other psychiatric diseases and control groups. It has been proposed that neurocognitive injury plays a key role in the development and maintenance of the disorder, supposing a fundamental aspect in the expression of BPD.⁵

In addition to the findings that imply a high likelihood of neurobiological injury in this patient group, other studies have verified that the severity of the brain damage has a positive correlation with severity of behavioral disorders.^{6,7}

Even though all of these research studies have indicated neuropsychological differences between patients with BPD disorder and other psychiatric groups or healthy control groups, there is still no agreement when proposing a motto consistent with cognitive alterations in this disease. For example, a study performed at the end of the 80s was not capable of detecting differences between BPD patients and a healthy control group in the cognitive domains of memory, language and spatial function,⁸ and shortly afterwards, the neurocognitive function of BPD was studied, revealing different alterations in memory and visual discrimination tests in comparison with healthy controls.⁴

Many of the neuropsychological investigations on BPD have used more complete neuropsychological batteries that seem to identify more specific cognitive alterations. BPD

patients have been compared with healthy controls in different cognitive domains, finding that BPD patients scored worse in visuospatial skill tests, processing speed and non-verbal memory tests while no significant differences were found in attention and verbal memory tests.⁹ Another study demonstrated that the patients scored worse on tests that evaluate planning and decision-making, but did not find differences in visual memory test, including visual recognition.¹⁰ In one study by Anthony C. Ruocco. (2005), the results revealed significant differences between BPD and the group in multiple neuropsychological domains (attention, flexibility, cognitive, learning, memory, planning, processing speed and visuospatial skills). According to this author, the data obtained are consistent with those obtained in another study and show significant correlations between neuropsychological measures of the frontal lobe function and BPD symptoms in a sample of young normal adults¹¹ and a sample of brain damage subjects.¹²

Patients with BPD have problems controlling impulses, above all in the stress context. Several studies in functional neuroimaging techniques in patients with BPD have demonstrated the implication of the prefrontal cortex and, more specifically, of the orbitofrontal regions, in the impulsive and aggressive responses that characterize the behavior of these patients.¹³ Among the results obtained, a decrease in the activity in the prefrontal regions, especially in the orbitofrontal ones (Brodmann's areas 9, 10 and 11), was observed in comparison with a control group. Furthermore, a negative relationship was found between the decrease of metabolism or prefrontal activity and the scores obtained by the patients in the scales evaluating impulsivity and aggressivity. Structural alterations that mainly affect the frontal and limbic regions have also been described.¹⁴

In disorders such as schizophrenia, neuropsychological damage has also been observed, and cognitive disorders similar to those observed in patients with schizophrenia have even been described in the schizotypal personality disorder. After applying a neuropsychological battery to a group of patients with schizophrenia and to another diagnostic group of schizotypal personality disorder, results were obtained that corroborate the idea that the cognitive skills related with fronto-temporal functions are altered in the schizophrenia spectrum disorders.¹⁵

Given the existing lack of consensus when a neuropsychological disease profile is planned in patients with BPD, in this preliminary study, carried out in the Research Unit of the Psychiatry Department of the Hospital Clínico San Carlos, we have aimed to observe the characteristics that hospitalized BPD patients have in the performance of a neuropsychological battery in order to define how the neuropsychological disease develops.

By means of this study, an attempt is being made to observe the skills that are the most deteriorated and which

neuropsychological tests cause the most difficulties for these patients in order to offer practical suggestions on how these findings, in combination with previous investigations, could help in the treatment of these patients and promote successive research.

From a political point of view, the neuropsychological study of patients with BPD taken on special importance. The cognitive profile of these patients may be an important prognostic factor and indicate the most adequate therapeutic strategies.

METHOD

A total of 26 patients diagnosed of BPD, 14 women and 12 men, included in the Day Hospital of the Psychiatry Department of the Hospital Clínico San Carlos, were evaluated. The patients were informed of the benefits of participating in the investigation and all demonstrated their consent to participate in the study. The exclusion criteria were the following: substance abuse dependence disorder, history of severe brain trauma, history of neurological disorders, organic mental disorder, mental retardation and other psychiatric disorders. The patients were introduced into the study once there was sufficient affective and behavioral stabilization to make it possible to reduce the medication to the minimum. In this way, when they entered into the study, they could be receiving a standardized treatment consistent in an antidepressive drug (venlafaxine or duloxetine) and a hypnotic drug, if necessary. Only two patients received extended-release risperidone for the management of refractory impulsivity.

The neuropsychological battery applied to these patients was made up of different tests that evaluate the following cognitive domains: memory (fixation, consolidation and recovery processes) categorical evocation, cognitive flexibility, sustained attention, processing speed, inhibition control and working memory. This battery was administered by a specialized neuropsychologist and it had an approximate duration of one hour. The tests that made up the battery are detailed in the following.

- Trail Making. Test A: This test requires visual examination, numeric ordering and visuomotor speed. It measures attention.

Test B: It measures cognitive flexibility, that is, the capacity to change from one execution to another.

- Symbol Digit Modality Test. It is a test of sustained attention and processing speed. The stimulus consists in a sequence (that serves as a model) of geometric figures without meaning in which each figure corresponds to one number.

- Buschke Selective Reminding Test. Immediate and deferred declaration verbal memory. It makes it possible to

evaluate the fixation, consolidation and memory evocation processes.

- FAS. Verbal fluency test that requires the subjects to generate words beginning with a certain letter (F, A or S), with some restrictions: given names, numbers or two words with the same root are not permitted. This test evaluates the capacity of the patient to develop strategies aimed at searching for words that comply with the task requirements.

- Semantic categorical evocation of animals (extracted from the Integrated program of neuropsychological examination «Test Barcelona» [Peña-Casanova, 1991]).

- Letter Number. Corresponding to a series of digits and letters given orally for the immediate reproduction by the examined subject but ordered according to some criteria. It measures the skill to process and store information within a very short time interval and to generate a short-term representation of the stimulus. Related with working memory.

- Stroop Test. It contains names of colors (RED, GREEN, BLUE) printed in a color different from that corresponding to the written word. The subject should say the color of the ink that the word is printed with. It measures resistance to the interference using performance in reading of colors of words in a 45-second period. Related with inhibition control.

- Wisconsin Card Sorting Test. It evaluates the formation of hypothesis, problem resolution, capacity to shift between categories, abstraction capacity and cognitive flexibility, in addition to the formation of concepts and planning.

RESULTS

The results of the present study revealed a deficit in the execution of neuropsychological tests, especially in recovery processes of immediate and deferred memory, working memory, sustained attention and processing speed, verbal fluency, impulse control, cognitive flexibility, abstraction and planning in the group of patients with BPD in regards to the normative data (table 1).

The difficulties observed in deferred free recall of the Buschke test reflect alterations in the recovery processes (prefrontal etiology). This is because it evokes the words after offering the patients the semantic keys. These alterations in the recovery processes can be explained by an inadequate organization of verbal material to memorize and/or inadequate or nonexistent use of storing strategies. It may also be due to a slowdown in the storage process, that is, more time and a greater number of trials are needed to learn the verbal material.

Table 1 Mean scores in each neuropsychological test of the borderline personality disorder (BPD) patients and their corresponding normative values

Neuropsychological tests	Mean BPD scores	Control group scales
Buschke Test		
Immediate free recall	16.58	–
Immediate facilitated recall	10.23	–
Delayed free recall	9.23	–
Delayed facilitated recall	11.75	–
Stroop	37.31	49
FAS	35.35	38.75
COWAT	10.69	14.12
ANIMALS	16.92	–
Symbol digit	38.85	49.22
Trail making		
Part A	44.23	28
Part B	109.2	64.2
Letter number	9.08	–
Wisconsin (WCST)		
Completed categories	4.35	5.7
Intents 1st complete category	23.95	11.7
Failure to maintain set	0.65	–
Learning to learn	-6.53	0.5
Total errors	84.45	47.9
Perseverative answers	80.55	50.8
Perseverative errors	83.3	49.5
Non-perseverative errors	87.55	47.9
Response conceptual level (%)	84.75	45.1

Problems have been observed in regards to deferred memory and not to the immediate memory. This may be due to the fact that the transfer of information from one to another requires an organization and use of nemotechnical strategies. These alterations would imply damage to the prefrontal circuits on the subcortical level.

Furthermore, problems have been found in the execution of the tests that measure impulse control. Capacity to inhibit responses is an important aspect of the executive functions. It has been observed in different studies that the difficulties and impulse control directly affect social interaction and condition high sensitivity to the surrounding stimuli and consequently a great dependent on context.

Difficulties in the Trail Making test, Letter-Number and WCST reflect alterations in working memory, cognitive flexibility, abstraction, planning/organization a slowdown in the information processing. These are functions that correspond with and involvement of dorsolateral prefrontal zones. The planning and organization problems in

patients with BPD are manifested by difficulties to evaluate the requirements of the task, establish appropriate strategies to satisfy these demands, initiate the adequate plan, persist in the actions, carry out the necessary adjustments and complete the task successfully.

All of this suggests that patients with BPD have deficits in a wide range of neurocognitive areas such as in sustained attention, recovery processes of deferred memory, working memory, impulse control, cognitive flexibility, abstraction, planning, organization and processing speed.

Some authors have indicated that the deficit in the prefrontal functions with age become the central problem of the disorder, given their involvement in the social requirements, responsible behaviors or social skills.¹⁶ For this reason, it would be interesting to investigate at what point these cognitive alterations occur, since they could suppose the key to the development of BPD.¹⁷ As different authors state, a cognitive deficit in early ages of development could have cognitive, behavioral and interpersonal repercussions in the subsequent stages.

DISCUSSION

The results indicate that patients with BPD have abnormalities in neuropsychological functioning that affect several complex superior functions. These dysfunctions affect the management of information and programming of behaviors and undoubtedly are related with clinical and symptomatic manifestations of the disorder. The origin of these alterations has not been determined at present. In this sense, an important aspect to keep in mind in BPD is neurodevelopment. Development studies in children with borderline traits stress the importance of the use of neuropsychological data. Early descriptions on borderline personality disorder in children are full of references to cognitive problems and brain maturation. That possibility that patients with BPD have suffered maturity delays of brain development, learning difficulties and attention deficit hyperactivity disorders in childhood that have a significant influence in the development of the disorder is evaluated.⁷ For example, it was observed that delay in cortical maturation in ADHD is more prominent in the prefrontal lateral cortex, especially in the upper dorsolateral prefrontal region. These findings correlate with the studies conducted in patients with BPD and in which the neuroimaging tests reflect a significant hypometabolism in frontal and prefrontal regions.¹⁸ In the same way, the study of cognitive alterations in these patients has demonstrated cerebral dysfunction in dorsolateral prefrontal and orbital regions.¹⁰

Another investigation found that children with borderline traits demonstrated deficits in executive functioning measurements (learning of errors, performance of responses on conceptual level, maintenance of the set and flexibility in the Wisconsin test, inconsistent levels of attention and show reaction times in the Continuous Performance Test) compared with a group of children with mixed psychiatric diagnosis who were comparable in regards to age and intelligence.¹⁹ In another study, the parents of children with borderline personality traits reported that they had more significant symptoms of neuropsychological dysfunction and attention deficit disorders compared with the information given by parents of children with traits of other personality disorders.²⁰ There are studies that mention the possibility of interruptions in the processes of neurodevelopment in childhood and adolescence without explainable environmental causes or drug treatment.

The prefrontal cortex is characterized as it is the last brain structure to mature. Its maturation processes extend over a prolonged time that includes childhood and adolescence, and includes creation and myelination of the neural circuits and increase of the synaptic density of the prefrontal regions. A parallelism has been established between the prolonged time in which these maturation processes are noticed and the development of executive functions. Because of all this, and because its development

is modulated by the previous acquisition of other cognitive skills with which it maintains a close relationship, such as attention and memory, slowness in its development, and the wide distribution of the circuits that support them, the executive function are especially fragile during childhood and adolescence. The study of the development of these functions from early ages not only makes it possible to understand the characteristics of this process but also facilitates the detection and prevention of common alterations in neurodevelopment disorders.

These findings support the hypothesis that patients with BPD could benefit from the application of neuropsychological rehabilitation programs aimed at the type and grade of the neurocognitive difficulties they have. They also support the idea that the cognitive improvement would be reflected in an improvement of the clinical symptoms and would thus have a positive impact on the general functioning of the patient.

The effective use of neurocognitive rehabilitation in schizophrenia is documented in the psychiatric disorders. The cognitive rehabilitation programs that are used most in schizophrenia are the Integrated Psychological Therapy or IPT²¹ and Cognitive Remediation Therapy or CRT.²² There are randomized studies in our country that demonstrate a neuropsychological as well as clinical and functional improvement with these techniques in patients with schizophrenia.²³

Thus, those patients with BPD who present cognitive alterations could benefit from the application of neuropsychological rehabilitation programs aimed at the type and grade of the difficulties these patients have and it would also be of interest to evaluate if it has a positive impact on the general functioning in patients affected by this disease.

The cognitive functions that are the object of neuropsychological rehabilitation in Borderline Personality Disorder are: sustained attention, processing speed, recovery processes of immediate and deferred memory and executive functions of the prefrontal lobe. Due to the grade or intensity of the cognitive deficits in patients with BPD and the conservation of some insight or awareness of the deficit, cognitive rehabilitation could be effective in the treatment of this disease and provide results that can be extrapolated to the daily functioning of the patient, given that it could improve many of the problems the patients find in their daily life and thus the perception of their quality of life.

In any event, the neurocognitive intervention should not be limited to the neuropsychological improvement but should also have an impact on all the components of the disease, taking into account that the primary purpose is the functional objective of the patient. For this reason, the evaluation of the neurocognitive treatment should also count on the change in the psychopathological, cognitive and functional aspects.

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