Assessment of frontal functions in psychiatric patients during maintenance electroconvulsive therapy

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Evaluación de las funciones frontales en pacientes psiquiátricos durante el tratamiento con terapia electroconvulsiva de mantenimiento

Abstract

Introduction. *Previous studies on adverse cognitive effects of electroconvulsive therapy (ECT) have not found any significant alteration of the frontal functions after an acute treatment course. This study aims to assess frontal executive functions in psychiatric patients during maintenance electroconvulsive therapy (M-ECT).*

Subjects and methods. *Thirty two patients treated with M-ECT and 29 psychiatric patients never treated with ECT were evaluated with neuropsychological tests that assessed the following frontal functions: work memory, planning, cognitive flexibility, attention, visuomotor velocity, verbal abstract reasoning and phonetic verbal fluency.*

Results. *Multivariate global analysis did not detect significant frontal function tests differences between both groups. The M-ECT group only scored significantly lower on the FAS test, a test that measures phonetic verbal fluency. A significant correlation between number of previous ECT sessions and performance in the FAS was found.*

Conclusions. *The M-ECT patient group presented a phonetic verbal fluency alteration that may also be associated to the previous number of ECT sessions. No significant differences in the other frontal functions were detected.*

Key words: *Cognition. Depression. Schizophrenia. Electroconvulsive therapy. Memory. Frontal functions.*

Resumen

Introducción. *Los estudios previos sobre los efectos cognitivos adversos de la terapia electroconvulsiva (TEC) no han hallado una alteración significativa de las funciones frontales después de un curso de tratamiento agudo. El objetivo del estudio es evaluar las funciones ejecutivas frontales en pacientes psiquiátricos que siguen un tratamiento con TEC de mantenimiento (TEC-M) y que han recibido un número elevado de sesiones de TEC.*

Sujetos y método. *Treinta y dos pacientes tratados con TEC-M y 29 pacientes psiquiátricos controles que nunca habían sido tratados con TEC fueron explorados con tests neuropsicológicos que evaluaban las siguientes funciones frontales: memoria de trabajo, planificación, flexibilidad cognitiva, atención, velocidad, pensamiento abstracto verbal y fluencia verbal con consigna fonética.*

Resultados. *El análisis multivariante global no detecta diferencias significativas en las pruebas neuropsicológicas frontales entre los dos grupos. El grupo de TEC-M sólo obtuvo puntuaciones significativamente más bajas en la prueba de FAS, test que mide la fluencia verbal con consigna fonética. Se detecta una correlación significativa inversamente proporcional entre el número de sesiones de TEC previas y el resultado en la prueba del FAS.*

Conclusiones. *El grupo de pacientes tratados con TEC-M presenta una alteración de la fluencia verbal con consigna fonética, que además podría estar asociada al número de sesiones de TEC previas. No se detectan diferencias significativas en el resto de funciones frontales evaluadas.*

Palabras clave: *Cognición. Depresión. Esquizofrenia. Terapia electroconvulsiva. Memoria. Funciones frontales.*

INTRODUCTION

Maintenance electroconvulsive therapy (M-ECT) is a modality of out-patient treatment with ECT in which the patients receive sessions with variable time intervals according to their therapeutic needs. The M-ECT has been shown to be an effective treatment in the prevention of relapses in patients with recurrent psychiatric disorders

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who have demonstrated good initial response to treatment with ECT[1-3].

Treatment with M-ECT does not mean that there are adverse physical effects that are superior to those of the baseline ECT[4,5]. However, the adverse cognitive effects have not been systematically studied. The data are based on single case studies[6-8], retrospective studies without control group[9] or subjective assessments on cognitive loss[10]. The studies that use the Mini Mental State Examination (MMSE) test conclude that the M-ECT does not produce effects on the general cognitive state of the patients[11-13].

Most of the studies on the adverse cognitive effects of ECT have been performed with patients who follow an acute treatment course. During the baseline ECT (10-12 sessions close in time), a transitory dysfunction of the electrophysiological mechanisms and more specifically, an alteration of the long term potentiation (LTP) is produced[14,15]. This transitory electrophysiological dysfunction has been related with reversible amnesia, that would fundamentally involve the declarative memory systems[16-18]. Few studies have assessed executive functions in patients treated with ECT. These have not found any significant differences in the frontal test performance before and after acute treatment with ECT[19,20]. Recently, the American Association of Psychiatry, in their treatment guide for ECT, has concluded that this treatment does not produce side effects on the frontal executive functions[2].

One of the fundamental limitations of the design of studies on cognitive effects of an ECT course is the interference of acute psychopathology in the cognitive performance of the patients. In this sense, the M-ECT designs make it possible to control this confounding variable, since most of the patients do not present affective or acute psychotic symptoms.

Up to the present, no controlled study has assessed the frontal executive functions in patients subjected to M-ECT treatment. In this study, we have assessed patients who had a good response to an acute course of treatment with ECT and who continued under treatment with maintenance ECT, with an interval between sessions greater than that of the initial course. Our objective is to study the possible effect of treatment with an elevated number of ECT sessions on the executive functions.

METHODOLOGY

Patients

There were 61 patients from the Day Psychiatric Hospital of the Hospital Clinic of Barcelona. Thirty two patients (19 diagnosed of depression, 12 of schizophrenia and 6 of bipolar disorder) were assessed during treatment with M-ECT. The main motive for treatment with ECT was the presence of affective symptoms resistant to drug treatment. Twenty nine psychiatric patients who had never been treated with ECT were assessed (18 diagnosed of depression, 15 of schizophrenia and two of bipolar disorder).

Method

All the patients were assessed in out-patient regime. The patients on M-ECT were assessed before the ECT session, the same day that they came to the Day Hospital to undergo the treatment. In this way, the time between sessions was maximum for each patient, to prevent the acute effects of the treatment as much as possible. The mean time interval between sessions was 37.9 days (SD = 15.7) and the number of previous sessions of ECT of the sample was 34.8 (SD = 18.1). The location of the electrodes was bilateral frontal-temporal and the apparatus used was a MECTA Spectrum 500.

Cognitive and clinical assessment

A complete battery of frontal neuropsychological tests and the MMSE[21] were used as indicator of the general cognitive state of the patient. The frontal executive functions tests used were: inverse digit subtest, coding subtest and similarities subset of the Wechsler Adult Intelligence Scale (WAIS)[22], the FAS phonetic verbal fluency test[23], tower of Hanoi[24] and Trail Making A and B[25]. Table 1 shows the executive functions assessed by each test.

By the 21-ítem Hamilton Depressive Rating Scale (HDRS)[26], the present affective symptoms of both patients under M-ECT as well as the controls were assessed. No study patient presented psychotic or acute affective pathology at the time of the neuropsychological examination. All the study patients obtained 8 points or less on the HDRS (table 1).

Statistical analysis

The SPSS computer program, version 10.0 for Windows, was used. A multivariant analysis (MANOVA) was used to analyze the differences between frontal cognitive tests between the two groups, comparing the group of patients treated with M-ECT and the control group.

TABLE 1. Neuropsychological battery of frontal executive test

Executive functions	*Neuropsychological test*
Work memory	Inverse digits (WAIS)
Planning	Tower of Hanoi
Attention	Trail Making A
Cognitive flexibility	Trail Making B
Abstrac verbal reasoning	Semejanzas (WAIS)
Visuomotor velocity	Coding (WAIS)
Verbal phonetic fluency	FAS

Pearson's correlations were performed to determine a possible relationship between cognitive performance of the patients and the number of previous sessions of ECT. $p < 0.05$ values were considered significant.

RESULTS

No significant differences were found between the mean age of the M-ECT group and the control group ($F [1.60] = 0.04$; $p = 0.84$). Mean and standard deviations of the HDRS were 47.31 years (SD = 18.93) and of the control group 48.27 years (SD = 19.21).

No significant differences were observed in the scores obtained by both groups in the HDRS scale ($F [1.60] = 1.29$; $p = 0.26$). Mean and standard deviations of the HDRS were 3.7 (SD = 2.6) in the M-ECT group and 3.0 (SD = 2.1) in the control group. Furthermore, no significant differences were observed between groups in the MMSE score MMSE ($F [1.60] = 0.33$; $p = 0.57$). The mean of the M-ECT group in this test was 28.1 (SD = 1.4) and the control group 28.3 (SD = 1.5).

Comparing the patients treated with M-ECT and control patients, a global significance was not observed in the difference between performance of the frontal tests of both groups ($F [1.60] = 0.62$; $p = 0.78$). When the univariate contrasts are analyzed, significantly lower performance of the M-ECT group is observed in the phonetic verbal fluency test ($F [1.60] = 4.39$; $p = 0.04$).

Analysis of correlations showed a significant inversely proportional correlation between the number of previous sessions of ECT and the FAS test ($r = -0.482$; $p = 0.005$). Other significant correlations between the number of previous sessions and the rest of the frontal cognitive tests were not detected.

Table 2 shows the means and standard deviations of the two groups in the frontal tests administered.

CONCLUSIONS

The M-ECT group presents an inferior performance in the phonetic verbal fluency test. No significant differences were observed in other executive functions examined: work memory, planning, attention, cognitive flexibility, verbal abstract reasoning and velocity.

Our results confirm those obtained by previous investigations[20] and indicate that there are no significant differences in the global performance of the frontal functions between patients with ECT and control patients. In this way, we find a coincidence between the neuroimaging studies that indicate that the ECT does not produce significant changes on the frontal-basal systems[27] and the neuropsychological studies that show that the executive functions associated to these areas are conserved.

The univariate analysis of the cognitive tests detects a significant difference only in the phonetic verbal fluency test. Studies with neurology patients and functional neuroimaging have associated the phonetic fluency test to frontal areas[28,29]. The significant inversely proportional correlations that we have detected could reflect an association between the number of previous sessions of ECT and the performance on this test. Our study is exploratory and the results should be considered as preliminary and should be cautiously interpreted, since the design presents some limitations. One of them is the clinical heterogeneity of the sample, that coincides with the heterogeneity of the patients treated with ECT. The groups could not be exactly the same according to the different psychiatric diagnoses, although the small differences between groups do not seem to explain the results obtained. It also was not possible to control the heterogeneity of the psychodrug treatment of both groups and this variable should be considered as one more confounding variable of the study.

Psychopathological interference during the cognitive assessment makes up one of the principal limitations of the studies with acute patients who undergo treatment with an acute course of ECT[30,31]. In our study, the patients were euthymic and had no acute psychiatric pathology at the time of the cognitive assessment. Consequently, we can suppose that the performance in the cognitive tests of the study patients is not significantly influenced by an attention deficit associated to an acute psychopathological state.

In conclusion, in our study, we have not found a global involvement of the executive functions in the group of patients treated with M-ECT. These results coincide with the previous studies, that did not find significant cognitive effects associated to M-ECT. However, the selective alteration of phonetic fluency should be considered in the design of future studies on ECT and cognitive functions. These should include extensive neuropsychological batteries that examine other cognitive functions besides memory. The study of other functions such as the frontal ones, in patients undergoing ECT treatment, is very scarce and should be extended to reach more consistent conclusions. The unquestionable clinical efficacy of the M-ECT is essential for its indication but the assessment of clinical advantages and possible disadvantages of this treatment should also be taken into account.

TABLE 2. Means and standard deviations of the frontal cognitive test of the M-ECT group and control group

	M-ECT group		*Control group*		*F*	*p*
	Mean	*SD*	*Mean*	*SD*		
Inverse digits (WAIS)	3.9	1.1	4.0	1.1	0.22	0.637
Tower of Hanoi	13.5	6.2	12.6	7.1	0.27	0.606
Trail Making A	61.2	41.2	51.5	30.3	1.08	0.303
Trail Making B	162.0	120.7	136.1	94.5	0.86	0.357
Similarities (WAIS)	13.4	5.1	14.9	4.4	1.49	0.226
Coding (WAIS)	36.2	17.2	40.5	13.8	1.16	0.285
FAS	27.1	11.3	32.6	8.8	4.39	0.040

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