

## **Neuropsychological abnormalities in a patient diagnosed with frontoparietal meningioma.**

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### **Abstract**

**Meningioma is a benign type of brain tumor. This type of tumor usually grows very slow. However, it can compress brain tissue. Publications about secondary Neuropsychological alterations to a diagnosis of meningioma are generally sparse, but there are studies that indicate cognitive deficit in attention, memory, executive functions and visuoconstructive skills.**

**Objective: To identify Neuropsychological alterations in patients with diagnosis of frontoparietal meningioma.**

**Participant: A 52-year-old female patient, married, right-handed and who is an artist. She shows a clinical picture of head trauma without loss of consciousness accompanied by a persistent headache. A radiograph of paranasal sinuses taken showed a normal result. The image of brain scan showed a 2.7 × 2.4 cm meningioma located in the left frontoparietal area with hyperostosis.**

**Materials: A protocol of neuropsychological evaluation was applied with MMSE test, digit span test, TMT (A/B), Babcock story recall test, Rey-Osterrieth complex figure test, clock-drawing test, memory test, Frontal Assessment Battery (FAB) and a verbal fluency task.**

**Results: It was found that the patient had difficulty to handle immediate information associated with a possible dysfunction of the frontal lobe (working memory), inability to recall material given by auditory pathway (delayed verbal memory). It was found that the patient was unable to generate verbs or alternation of the same (Executive functions), affecting her quality of life to a lesser extent.**

**Conclusions: The results indicate that the patient presents Neuropsychological alterations which are associated with frontal lobe. It is suggested to carry out plans of functional Neurorehabilitation which aim at the improvement of the quality of life of the patient, or future people with this type of diagnosis.**

**Keywords:** Neuropsychological alterations, Attention, Memory, Executive functions, Visuospatial functioning, Meningioma.

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### **Introduction**

Meningioma is an intracranial tumor of benign type that adheres to Dura mater [1,2]. Sometimes it does not present any symptoms and it is very rare that it becomes malignant. Occasionally this tumor has malignant recurrence with metastases outside the central nervous system [1].

The incidence of meningioma brain tumor occurs in the middle age and it is prevalent in women [3].

The treatment for this kind of tumors consists of a surgical removal of the lesion in the affected area, taking as a priority

the minimal risk for patient [1]. Despite the benignity of the tumor does not usually represent conditions of cognitive order for patients who have been diagnosed with meningioma, there are studies [4-7] indicating a profile of cognitive impairment after surgery.

Data from different studies demonstrate the existence of cognitive deficiencies compared to control subjects, alterations to process perceptual information, long-term memory, working memory and executive function tasks related to frontal lobe.

Other studies [4,8] point out alterations to perform tasks of digit span, selective attention [4], language, perception, emotional area and personality [4].

The objective of this work is to investigate the alterations Neuropsychological presenting a patient with a diagnosis of brain type frontoparietal meningioma.

## Method and Materials

### Participant

The case focuses on a 52-year-old female patient, married, right-handed who is an artist with upper middle schooling. The patient showed a clinical picture of head trauma without loss of consciousness accompanied by a persistent headache. A radiograph of paranasal sinuses was taken and it showed a normal result. A brain scan showed a  $2.7 \times 2.4$  cm meningioma located in the left frontoparietal area with hyperostosis.

In the neurological examination the patient was conscious, alert and oriented in her individual temporal and spatial fields.

In the physical examination was found blood pressure-120/80 mmHg, Pulse-80/min, respiratory rate-20/min.

Resection of the tumor (frontoparietal meningioma) took place. In medical history there is no report of complications during surgery. Clinical evolution was satisfactory without apparent neurological deficit. The patient was alert, oriented and expressive. Post-surgical management began with Phenytoin 100 mg every 8 hours and Cephalexin 500 mg every 6 hours for 7 days to prevent infection of the surgical wound, and Acetaminophen 500 mg (2 tablets every 6 hours for 15 days).

On the emotional level the patient does not present clinical pictures of depression, anxiety and apathy.

### Materials: Neuropsychological assessment

**Mini-mental state examination-MMSE:** (Folstein, Folstein and McHugh, 1975; Spanish Adaptation by Wolf, Marcos and the Zarademp group, 2002) [9].

It is a brief cognitive tracking test that assesses cognitive functions. It is made up of 30 sections and grouped into five dimensions: Orientation (10 points), fixation (3 points), calculation and memory (3 points), language (8 points) and visuoconstructive skills (1 point).

**Digit span test [10]:** It is a sub-test of the WAIS (Wechsler Adult Intelligence Scale) that aims to measure the levels of attention and immediate verbal memory in the subject.

**Trail making test [11]:** Using a pen or a pencil and a piece of paper, this test aims to measure the levels of attention (part A). The subject must join the numbers from 1 to 25 consecutively and executive functions (part B) which consist of joining the numbers from 1 to 13, but alternating with letters (1A-2B-3C-4D-5D and so on). The subject must take the test in the shortest possible time.

**Babcock story recall test [12]:** It aims to evaluate deferred and verbal memory. The proof is provided by the auditory pathway.

**Rey-Osterrieth complex figure test [13]:** It is a test that aims to assess visuospatial memory and following capacity. For the clinical case, we have only focused on the assessment of the immediate and delayed memory.

**Clock test [14]:** It is a test of screening or brief cognitive tracking that aims to evaluate the cognitive functions in patients with neurological diseases or neurodegenerative diseases.

**Memory test:** It is a test that aims to assess the immediate and delayed verbal memory. A series of words is read to the subject and then he or she must verbalize them. After a while, the subject is asked to remember the word list again.

**Frontal assessment battery [15]:** It is a specific test that measures the Executive functioning and deficit or low cognitive performance, in elderly or adults diagnosed with a neurodegenerative disease.

**Verbal fluency:** The subject does a task in which he or she must name animals and people in a minute. It is also done in a different way where the subject must name a word alternating it with a category demanded by the evaluator. Your score is obtained by the sum of each of the successes.

### Procedure

The evaluation was carried out eight (8) months after surgery. The following steps were performed:

1. The patient interview
2. Review of medical history
3. Neuropsychological evaluation
4. Neuropsychological report
5. Neurorehabilitation functional plan

### Ethical aspects

The patient and her companion in common agreement with the principal investigator, signed informed consent manifesting the process that was going to be carried out with the patient. Protection of her personal data was guaranteed. The patient was told that the evaluation was going to be pen and paper and it did not represent any physical risk. The study was conducted taking as a reference the ethical principles for the development of research or experimentation on humans. In this case, the Declaration of Helsinki and the Berne Declaration.

### Results

The results of each of the neuropsychological tests are presented in Table 1.

**Qualitative results**

The findings were the following:

**Temporal and spatial orientation:** The patient is oriented in her dimensions of time, place and space. The results obtained by MMSE indicate that the patient does not present any kind of alteration. The results are within the expected range.

**Attention**

The patient did not show any type of disturbance on tests measuring attention. In this case, it was TMT. The patient could keep attentional focus during the test (part A and B). Similarly, we found evidence of cognitive interference. The patient focused on performing the task at the time of choosing meaningful stimuli (selective attention). Nor is there evidence of alteration to change her attentional focus. The patient is able to solve tasks that present different stimuli from lesser to higher degree of complexity (alternating attention).

**Table 1.** Score obtained in different tasks Neuropsychological depending on the location of the left frontoparietal Meningioma.

Test	Type	Maximum score	Score
MMSE		30	28
Digit Span test	Direct	16	8
	Inverse	16	8
TMT	A		65"
	B		75"
Babcock story recall test	Immediate	21	12
	Delayed	21	10
Rey-Osterrieth complex figure	Copy	36	36
	Memory	36	19 (Percentile)
Clock test	y	10	10
	Memory	10	10
Memory test		12	5
		18	16
Verbal fluency	Animals		13
	People		26
	Alternate		2

**Memory**

The memory of the patient was evaluated with Digit Span test, Babcock story recall test, clock test, Rey-Osterrieth complex figure test and a task of immediate and delayed verbal memory test.

**Working memory:** During the evaluation it was found that the patient had difficulty processing immediate information in short term material. The patient is unable to retain new

information. We also found a very low score on Digit Span test and the results lead to affirm that the patient has difficulty to manipulate immediate information presented.

**Delayed verbal memory:** The patient has difficulty to evoke the information given immediately. Evaluated with Babcock story recall test, we can say that the patient is not able to explain the structured verbal material presented by the auditory pathway. Similar situation is for the Rey–Osterrieth complex figure test. By visual means the patient does not tend to present any alteration in visuospatial memory. Nevertheless, when reproducing the copy, it is identified that the patient remembers a number of details, but not the entire figure. This leads to infer that the constructive visual memory is altered and that it is possibly associated with age. Then the memory test found that the patient presents a lower score than expected, corroborating that she is unable to evoke, process and store the information for short-term memory processes.

This contrasts with clock test, identifying that the patient in both applications (order and copy) shows motor and visual organization, with good ability to execute the task.

**Executive functions:** At a general level the patient does not present patterns of Executive dysfunction assessed by the FAB. However, she presents alterations to perform tasks of conceptualization and lexical fluency, situation that can be preferably associated with her frontoparietal meningioma (it covers the functions of the frontal lobe). As for the results that can be confirmed in verbal fluency tasks, when naming animals and people, the patient did not say the names of wild animals in a required time (1 minute). It was different when the patient named people and she got a higher score in this task. However, in the alternating verbal fluency task the patient only obtained two points, results that are compatible with dysfunction shown in working memory and mental flexibility.

**Discussion**

Data obtained from the results of the tests indicate that the patient presents Neuropsychological alterations in cognitive domains such as working memory. Meskal et al. [16] point that subjects cannot process immediate information in short-term memory. Being unable to manipulate information, they end up losing the evocation and consolidation of material, especially the one which occurs through a hearing. The delayed verbal memory is also affected [5]. The patient cannot access the memory previously learnt. This situation tends to be of less difficulty and it showed that her visuoconstructive memory is not fully altered [5]. But it has begun to deteriorate, possibly due to age and diagnosis of meningioma [4]. Despite the patient presents a good Executive functioning, it could be identified that conceptualization and cognitive flexibility States tend to be altered. Data that are recorded by different research [5-7,17], indicate that the frontal lobe is responsible for planning, organizing and directing behavior. In the case of the patient, presenting her meningioma in the front, it is considered that there is inability to form concepts and create verbs,

especially those that require an alternation and semantic knowledge of the object.

The Inability that the patient shows to generate verb is related to the difficulty presented in cognitive flexibility, which may be associated with age. In other words, this variable is a predictive factor that explains the deterioration of cognitive impairment [4], or that may be related to surgery or the pressure that meningioma puts on brain tissue. Currently, little is known about the impact that a meningioma can have on cognitive functions. However, it has been found that this type of slow-growing tumors, and unlike of tumors greater commitment, they negatively affect activities of daily living, and the quality of life of patients who suffer from them [4]. Future research lines should focus on plans for functional Neuro-rehabilitation having as objective diagnosis and early treatment.

### Conclusions and Recommendations

- Despite its benign nature, Meningioma is a tumor that generates cognitive deficit in working memory, delayed memory, and verbal fluency (cognitive flexibility) tasks.
- It is necessary to make an early diagnosis, with the aim of preventing higher Neuropsychological alterations in patients with diagnosis of Meningioma.
- The health system must create systematic strategies that identify the diagnoses of different brain tumors. Then, plans for functional Neurorehabilitation must be performed in order to improve the quality of life in each of the patients.
- It is necessary to generate more research lines in benign tumors that will allow more heuristic and knowledge application of this type of pathologies.

### Limitations

The assessment to the patient was after her surgery. There was no knowledge of it previously. It would have been important to carry out a comparative clinical picture before and after surgery.

### References

1. Barkhoudarian G, Whitelegge JP, Kelly DF, Simonian M. Proteomics Analysis of Brain Meningiomas in Pursuit of Novel Biomarkers of the Aggressive Behavior. *Journal of proteomics and bioinformatics*. 2016; 9: 53-57.
2. Doleželová H, Hynková L, Pospíšil P, Kazda T, Slampa P, Coupцова I. Therapeutic results of the treatment brain tumors using radiosurgery and stereotactic radiotherapy. *Klinicka onkologie: casopis Ceske a Slovenske onkologicke spolecnosti* 2011; 25.6: 445-451.
3. Gazzeri R, Marcelo G, Gazzeri G. Giant olfactory groove meningioma-ophthalmological and cognitive outcome after bifrontal microsurgical approach. *Acta neurochirurgica*; 2008; 150.11: 1117-1126.

4. Meskal I, Gehring K, Geert JM, Sitskoorn MM. Cognitive functioning in meningioma patients: a systematic review. *J Neur Oncol* 2016; 1-11.
5. Tucha O, Smely C, Preier M, Becker G, Geraldine M, Lange W. Preoperative and postoperative cognitive functioning in patients with frontal meningiomas. *J Neurosurg* 2003; 98: 21-31.
6. Koizumi H, Ideguchi M, Iwanaga H, Shirao S, Sadahiro S, Oka F. Cognitive Dysfunction might be improved in association with recovered neuronal viability after intracranial meningioma resection. *Brain Res*; 2014; 1574: 50-59.
7. Yoshii Y, Tominaga D, Sugimoto K, Tsuchida Y, Hyodo A, Yonaha H. Cognitive function of patients with brain tumor in pre- and postoperative stage. *Surg Neurol*; 2008; 1: 51-61.
8. Krupp W, Wolfgang MD, Klein C, Koschny R, Holland H, Seifert V. Assessment of neuropsychological parameters and quality of life to evaluate outcome in patients with surgically treated supratentorial meningiomas. *Neurosurgery*; 2009; 64: 40-47.
9. Lobo A, Saz P, Marcos G. Mini-Mental Status Examination. 2001; Tea ediciones.
10. Weschsler D. Weschsler Memory Scale. The Psychological Corporation, 1972.
11. Ralph M. Trail Making Test: Manual for administration and scoring. Reitan Neuropsychology Laboratory, 1992.
12. Babcock H. An experiment in the measurement of mental deterioration. *Archives of Psychology* 1930; 117: 105.
13. Rey A. Test de copia de la figura compleja. Madrid. TEA 1987.
14. Cacho-Gutierrez LJ, García García R, Arcaya Navarro J, Vallardón V. Una propuesta de aplicación Del test Del reloj en la enfermedad de Alzheimer. *Revista de Neurología* 28; 1999: 648-655.
15. Dubois B, Slachevsky A, Litvan I, Pillon B. The FAB A frontal assessment battery at bedside *Neurology*; 2000: 1621-1626.
16. Meskal I, Gehring K, Van der Linden S, Rutten GJ, Sitskoorn M. Cognitive improvement in meningioma patients after surgery: clinical relevance of computerized testing. *Journal of neuro. Oncology* 121.3: 2015: 617-625.
17. Van N, Klein D. Stalpers M, Leenstra LJ, Heimans S, Riejneveld JC. Differential effect of surgery and radiotherapy on neurocognitive functioning and health -related quality of life in WHO grade I meningioma patients. *J Neurooncol* 2007; 84: 271-278.

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