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Cognitive Outcome of Immediate Post-Operative and Long-Term Follow-up After Surgery in a Giant Falcine Meningioma. A Case Report

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Abstract

Meningiomas are the most common primary intracranial tumors in adults; however, only approximately 9% of cases are located in the falx cerebri. Cognitive impairment in meningiomas tend to have an insidious presentation since they usually remain asymptomatic while they are small in size. However, when they grow, they may present deficits which require a detailed examination. This study shows the findings in the neuropsychological evaluation of a giant falcine meningioma case, in the immediate and long-term periods before and after surgery. After having the tumor completely removed, immediate neuropsychological evaluation revealed alterations in various cognitive domains and, as an unusual finding, a transient pure agraphia. Long-term evaluation showed that the surgery did not cause additional deficits, but instead led to a slight improvement in cognitive functioning. Anxiety was reported throughout the evaluation process, but only after the third month was depression reported. Neuropsychological evaluation in patients with meningioma is valuable for an early diagnosis and timely treatment that meets the cognitive and affective needs of each patient, thus favoring their quality of life.

Keywords: Giant meningioma; Falcine meningioma; Neuropsychological assessment; Cognition; Cognitive impairment; Transient pure agraphia

Introduction

Meningiomas are the most common primary intracranial tumors in adults; however, only approximately 9% of cases are located in the falx cerebri [1,2]. They tend to be dumbbell-shaped and often compromise the medial area of both hemisphere [3]. They are usually malignant and present a slow growing rate. Therefore, they can reach a large volume before becoming symptomatic due to brain plasticity [4]. Its clinical presentation depends on its size and location [5]. Cognitive and affective impairment tends to have an insidious presentation since they do not usually cause significant symptoms while they are small. However, when they grow in size, more serious deficits may appear [6]. The characterization of neuropsychological alterations in meningiomas has received more attention in the last five years after reports have suggested further consistent impairments in attention, memory and executive functions [7-13]. However, a few studies have reported in detail the cognitive state before and after surgery. The results are reported from the neuropsychological evaluation of a case of giant falcine meningioma in the immediate and long-term postoperative period.

Case Report

32-year-old man, right-handed, with high school education; native Spanish speaker and English as a second language; last worked as a bilingual call center consultant. He debuted with hemiparesis of the left hemi body, thus being referred to the hospital. Neurological examination upon admission revealed disproportionate left hemiparesis to 3/5 brachial predominance, with the presence of partial seizures. Upon questioning, the patient and the family notify forgetfulness (often forgetting the conversations he had hours or days before) and difficulty

concentrating (he gets easily distracted). In Magnetic Resonance Imaging (MRI), an extra-axial implantation tumoral injury in the lower third of the falx is observed in T1 sequence, enhanced with contrast medium, with bilateral frontal parenchyma displacement and ventricular collapse. T2 shows a hyperdense tumor lesion with a cleavage plane closely related to the pericalous arteries. The diagnostic impression is compatible with a giant falcine meningioma (See Figure 1). Antiedema and anticonvulsant drug treatment was initiated (Dexamethasone 8mg/8h and Levetiracetam 1 g / 12 h), and a week later a right frontoparietal craniotomy was performed; a tumor of a hard and bleeding consistency was found, proceeded to devascularize and debulking; subsequently achieving total resection of the tumor, with dimensions of 8x5cm. The histopathological result confirmed the diagnosis of transitional meningioma grade I.

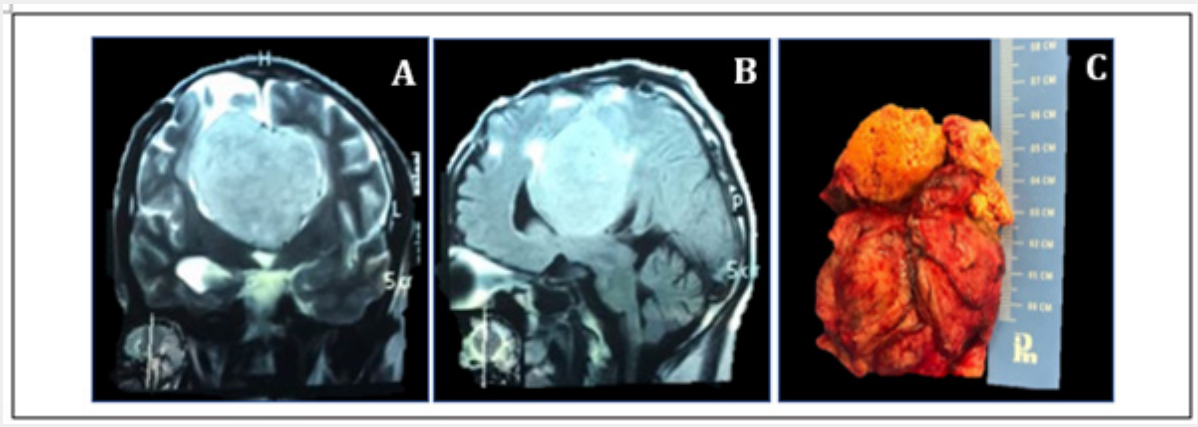

Figure 1: MRI(A) T2 sequence in coronal section shows axial hyperintense injury giant tumor implantation in the lower third of the falx displacement of pericalous arteries and cleavage plane. (B) Flair sequence in sagittal section, shows a tumor injury dependent of the falx of the middle third with displacement of adjacent structures and perilesional edema (C) Multilobular tumor of hard consistency, measuring 8cm x 5cm.

The evaluation of the cognitive and affective state was carried out with an extensive battery: Barcelona Test (TB), Rey-Osterrieth Complex Figure (ROCF), Word Learning Test, Stroop Test, Beck's Anxiety and Depression Inventory (BAI, BDI). The neuropsychological evaluation was performed one week prior to surgery and twice again, one and three months later.

Results

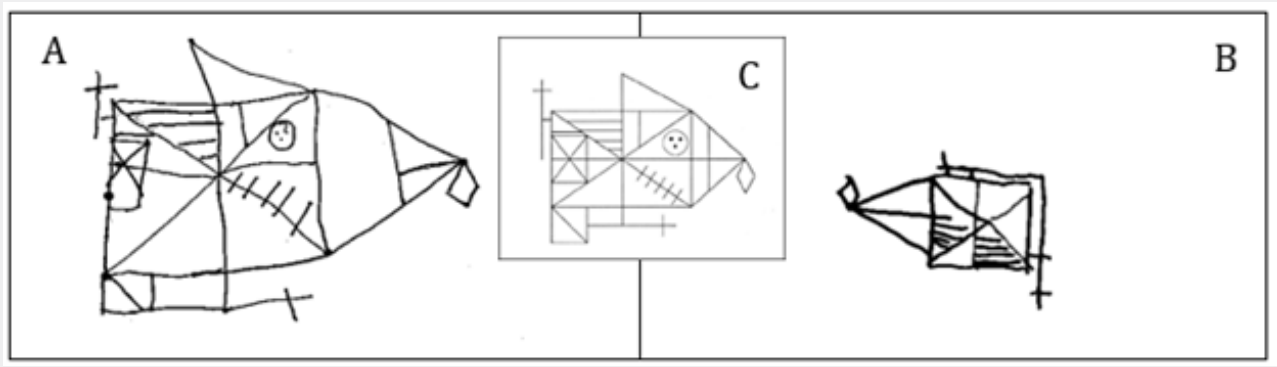

Figure 2: Pre (A) and immediate post-surgical (B) execution of the ROFC (C). In (A) the execution of the copy with visuospatial errors (disproportion, displacement) can be seen. In (B) rotated recall (180°) and omissions errors are appreciated. Which are not repeated in the long-term evaluation.

The pre-surgical neuropsychological evaluation showed slight to moderate deficits in executive functioning, showing difficulties in planning, self-monitoring and verification; impacting the correct functioning of the most complex forms of attention and memory (selective, sustained and alternating attention; working memory and evocation). Failures in visuospatiality, visuoconstruction

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(See Figure 2) and ideomotor apraxia were also observed. In the immediate postsurgical evaluation, persistence of the deficits of the previous assessment was shown, and as an unusual finding, a pure agraphia at the grammar level was temporarily presented (See Figure 3). In the follow-up assessment, the difficulties in the executive component, observed from the pre-surgical evaluation, were maintained; however, evidence of improvement was found, thus reducing severity to a mild range. There was also remission of the agraphia (See Figure 3) meaning no added cognitive dysfunction from the surgery was evident. Regarding the affective state, moderate anxiety values were reported prior to the surgery and went on throughout the evaluations, while the presence of mild depressive symptoms was reported only at the three-month assessment.

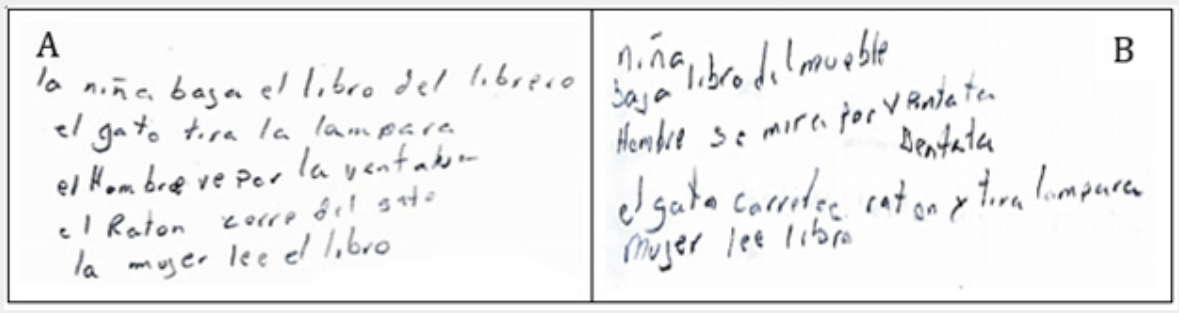

Figure 3: Pre (A) and immediate post-surgical (B) execution of the TBA Narrative writing task. In (B) a transitory pure agraphia is appreciated, which remits in the long-term evaluation. It should be noted that there were no alterations in expressive language.

Discussion

Neuropsychological assessment

The neuropsychological evaluation allowed us to explore the cognitive and affective state in a case of giant falcine meningioma, in the immediate and long-term postoperative period. Before surgery, the data revealed failures in executive functioning as well as in complex forms of attention and memory, which slightly decreased in the evaluation performed three months after surgery. Both sets of data are congruent with what was reported in previous studies, where it was stated that the majority of people with meningiomas present deficits in various cognitive processes prior to surgery, the most consistent being attention, memory and executive functions. They improve after surgery, although maintaining a lower performance than healthy subjects [8].

In our case, defects were also found in visuospatiality, visuoconstruction, and the presence of ideomotor apraxia, which can be associated with the mass effect, due to the size of the tumor (8 cm) and edema, that compromise various adjacent structures. In this regard, it has been reported that even though small meningiomas are generally cognitively benign, this may change as the tumor evolves and may be affected by the size and location [14]. Larger tumors (> 4 cm) cause more severe neurocognitive deficits than smaller ones. Those located in the anterior convexity show greater deficits in executive function, while those in the posterior convexity present greater deficits with association in the parietal cortex [6]. It should be noted that due to the size of the meningioma and its extensive involvement by compression of various lobes of both hemispheres and of the corpus callosum, various cortical and callosal signs were explored, without detecting findings other than those described. Results similar to those reported in the exploration of a large lateral ventricular meningioma with callosal involvement [15]. The immediate postsurgical evaluation had an unusual finding of a transitory pure agraphia, which remitted within the three-month evaluation. This could be explained by postsurgical changes such as increased perilesional edema. Although we have not found a similar finding in the literature, this may be due to the fact that it was found in a very short postoperative period (1 month). Studies with less than 3 months of evaluation have reported more severe symptoms, which nevertheless remit or improve in subsequent evaluations [8].

Regarding the affective state, our case presented moderate anxiety during the three stages and mild depression three months after surgery. This data matches other findings where the presence of anxiety was indicated, prior to surgery and up to 1 year after it; while depression is reported from the third month on [16]. Other reports indicate that 40% of patients who undergo surgery for meningioma experience emotional and cognitive problems [17].

Treatment strategy for falcine meningiomas

Treatment of first-line meningiomas is surgical. The techniques used vary according to the location along the falx. The interhemispheric approach through a midline crossover craniotomy is most often used to treat these falcine menigiomas. A dumbbell-shaped type of anterior or middle third tumor requires a bicoronal or linear incision, whereas for posterior third tumors, a bottom-based U-shaped flap that is wide enough to allow for a bilateral occipital craniotomy should suffice. The bone flap is recommended to be performed 2-2.5 cm from the midline

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on both sides. The dura opens on the side of the non-dominant hemisphere or on the side of the largest component of a dumbbell-shaped tumor. This dural incision extends to the lateral portion of the superior sagittal sinus. Bridging veins are released from the cortex for a few millimeters to give the required exposure without damaging them [18].

The medial surface of the hemisphere is gently retracted to identify the anterior and posterior boundaries of the tumor. Before internally decompressing a tumor, the anterior and posterior margins of the falx are divided from superior to inferior, preferably with a margin of 1 cm or more from the edge of the tumor, so as to interrupt the blood supply to the tumor from the arteries of the sickle. The key is to perform extensive internal decompression of the tumor and gradually remove the capsule towards the decompression area. Sometimes the tumor is sectioned parallel to the falx to facilitate the handling of the capsule. In some patients, bilateral exposure is required [19]. At some point during the operation, depending on the size and configuration of the tumor, the falx is well separated from the tumor junction. Caution must be taken to prevent injury to the branches of the anterior cerebral artery, such as the pericallosal and marginal callosal arteries, and extreme care must be taken with the draining veins on the surface of the cortex, in order to avoid strokes as in these types of tumors, venous drainage is greatly altered.

Conclusion

Cognitive impairment in meningiomas tends to have an insidious presentation, since they usually seem to remain asymptomatic while they are small, however, when they grow, they can present severe deficits. A detailed neuropsychological assessment at an early stage can help in the early identification of subtle deficits in cognition, affect, behavior or personality. Upfront meningioma treatment is surgical, and the findings reported in literature are consistent in pointing out that surgery, in most cases, can lead to improvement in cognitive functioning rather than cause deterioration. Personalized examination makes it possible to account for the diversity of clinical manifestations that may occur depending on the location and size of the lesion, especially in those > 4cm. The individualized profile allows a more accurate diagnosis of cognitive deficits and affective state, helping in decision-making throughout treatment in order to promote a better quality of life.

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Conflict of Interest

The authors declare no conflict of interest associated with the manuscript.

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