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Case Report

# Pterional Approach for a Tuberculum Sellae Meningioma: A Case Report

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## Abstract

The tuberculum sellae meningiomas represent between 5-10% of intracranial meningiomas, most frequently between the 5th and 6th decade of life. Bitemporal hemianopia, associated with optic atrophy, represents the most frequently found clinic symptoms. Treatment is usually surgical resection of the tumor either by transcranial or endoscopic endonasal approach. A case of a 44-year-old female patient who presented with a clinical symptoms of 5 months duration, characterized by progressive visual disorder caused by blurred vision on the left eye, associated with low-grade frontal headache, with simple cranial MRI study with evidence of T1 hyperintense lesion in the sellar region with an apparent dural tail that sits at the level of the sellar tubercle, and moves towards the posterior pituitary gland and pituitary stalk.

***Keywords:** Meningioma, tuberculum sellae, pterional craniotomy, Transylvian corridor.*

## Introduction

Tuberculum sellae meningiomas represent between 5% and 10% of intracranial meningiomas, most frequent between the 5th and 6th decade of life. They originate from the arachnoid that covers the sellar tubercle, sphenoid plane and chiasmatic groove. They are slow-growing lesions, and whose symptoms become evident when they cause compression of the structures adjacent to the lesion, with the ones located before them being the most involved, that is, those that pertain to the optic chiasm and optic nerve, that is why bitemporal hemianopsia, associated with optic atrophy represent the most frequently found clinical presentation, among the neuro-ophthalmological clinical findings [1,2,3,4,5], because the only route for the extension of the tumor is anterior, on the sphenoid plane, on the optic nerves or between the chiasm around the anterior cerebral artery complex. [6,7,8].

Cushing's chiasmatic syndrome defined as primary optic atrophy, bitemporal campimetric defects in young adults with apparently normal sella turcica on radiography is described as part of the clinical picture; when the chiasmatic syndrome is present and the visual symptoms are pronounced, the tumor may have reached a considerable size and compromise the adjacent structures, even invading both carotid arteries and compromising surgical success[4]. The first case was reported by Steward in 1899 in an autopsy. The first complete excision was performed by Cushing in 1916 [6,7,8]. The incarceration of the internal carotid that is exposed in the images determines to a great extent the degree of resection of this tumor together with the presence of effacement of the interface of the tumor with the brain. [2]

Treatment is usually surgical resection of the tumor either transcranially or endoscopically endonasal, although another option is radiation. Some studies show recurrences 5 years after surgery, even with total resections, so annual follow-up with neuroimaging is indicated. If they are removed early, the result is the recovery of normal neuronal function, but a delay in diagnosis or treatment can result in permanent visual loss [4,9]. There is no consensus on which is the ideal route for safe maximum macroscopic resection of lesions to the sellar tubercle, unlike the approaches for pituitary adenomas whose current gold standard is the transsphenoidal approach by endoscopic endonasal approach [10].

## Case Report

It is a female patient of 44 years of age, medical professional, from Santiago de Cuba, who reported to the hospital for further management, referred from neuro-ophthalmology unit, for having presented 5 months of progressive visual disorder, mainly left eye blurred vision, associated with frontal headache of low intensity, which is usually partially relieved with NSAIDs, and worsened in the evening, without other symptoms. She initially reported to the neuro-ophthalmology unit, where they performed further studies with the findings of visual acuity and visual field showing bitemporal hemianopsia, with evidence in of left optic nerve atrophy. As a result of these findings, a simple head computed tomography (CT) scan was ordered, which showed an isodense lesion with defined edges at the level of the sellar region (Fig 1a). She was therefore referred to the neurosurgery unit for evaluation and further management. On admission, on physical examination, a conscious patient, oriented in person, place, and time, with a Glasgow coma scale 15/15, without motor or sensory defects, with a Karnofsky scale of 100 points, evidence of bitemporal hemianopsia on confrontational campimetry, with no other positive finding on physical examination. Contrast-enhanced CT of the skull was ordered (Fig 1b) which showed a hyperdense, solid lesion, which homogeneously captured the contrast at the level of the tubercle of the sella turcica, with defined edges, without compromise of the perilesional bone structure. Also a Magnetic Resonance Imaging (MRI) of the brain was ordered (Fig 2) with evidence of the hyperintense lesion on extraaxial intracranial T1 in the sellar region with an apparent dural tail that sits at the level of the sellar tubercle, and displaced the pituitary gland and pituitary stalk posteriorly, without destruction of sella turcica compatible with sella tubercle meningioma; with biochemical laboratory studies and endocrinological studies in normal ranges. As a result, a comprehensive surgical decision was taken, a transcranial surgical procedure was advocated, through an anterolateral approach with a pterional craniotomy and a Transylvian corridor. The lesion anatomically was located on the sellar tubercle, in intimate compromise with the internal carotid artery in its clinoid segment. Respecting the surgical principles for surgery of cranial base meningiomas, the lesion was excised en bloc, obtaining a Simpson grade 1 resection. Patient recovered satisfactorily in his immediate post-surgical management, improvement in visual acuity. The post-surgical head CT tomography revealed a small homogeneous hyperdense lesion in the inferior gyrus frontal lobe, compatible with hemorrhagic contusion attributable to overexposure and significant retraction of the frontal lobes, without repercussions on the patient's symptoms, with expectant management; said contusion disappeared spontaneously when compared to the simple head MRI (Fig 3) performed 2 months after surgery. Partial improvement in visual acuity was reported by neuro-ophthalmology.

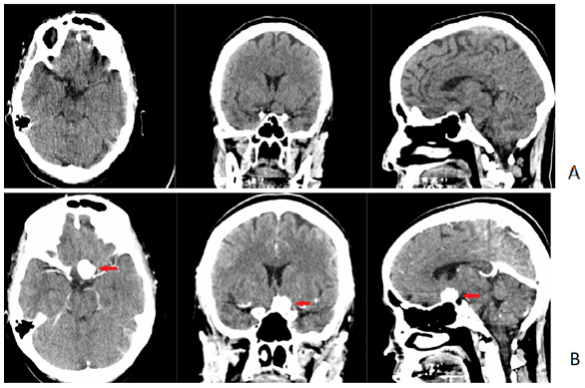


***Fig. 1:*** *A Y B. Simple and contrast CT scan before treatment, in axial, coronal and sagittal sections, respectively, the red arrow indicates homogeneous contrast uptake in thetuberculum sela (10x11mm).*

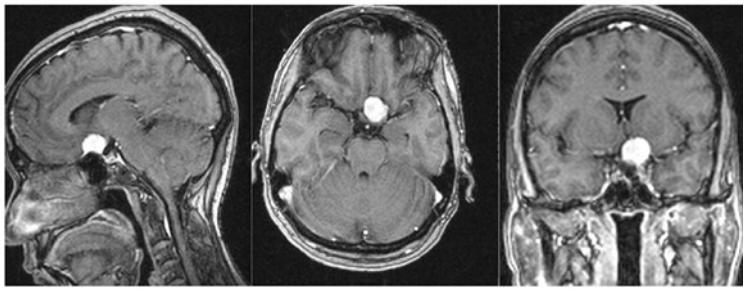

***Fig. 2:*** *MRI of head before treatment, Shows: Bright signal intensity in Tuberculum selae noted at T1 images.*

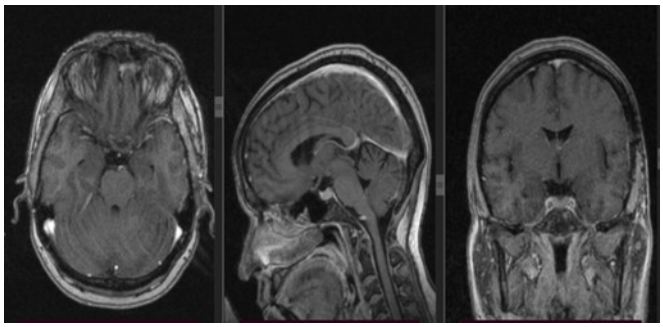

***Fig. 2:*** *MRI of the head after treatment Shows: Surgical Bed in Tuberculum selae noted at T1 images, where the absence of lesions is visualized.*

## Discussion

To access this suprasellar region, the unilateral frontal, extended frontotemporal approach, the bifrontal, subfrontal are mostly used but in this case the classic most frequently used Pterional approach was described. Also, among other techniques includes minimally invasive Key Hole surgeries such as mini-supraorbital craniotomy, and the extended transplanum-transtubercular endoscopic endonasal approach, which show notable results in these patients, increasing their efficacy and reducing their morbidity and mortality, [1,2,6,5,9,11]. Taking into account the two pillars of meningioma surgery: maximizing the extent of resection (EOR) and reducing the risk of recurrence while preserving neurological functions [12]. Highlighting the importance of evaluating pre and post-surgical visual perimetry to determine visual recovery [1].

Aftahy et al. proposed a decision-making algorithm for transcranial approaches, recommending anterolateral approaches in cases of optic apparatus involvement and multimorbidity, whilst median approaches are preferred in cases of large tumors determining mass effect and brain edema. An additional monolateral orbitotomy can be added to obtain a wide inferosuperior trajectory. As reported by Chokyu, the optic canals may be unroofed, depending on the degree of tumor invasion, thus increasing the visual improvement [12].

The anterior interhemispheric approach (AHA) is defended by authors such as Curey et al (2012), this being an approach whose advantage is allowing symmetrical vision and control of the optical apparatus, ICAs and their terminal, and distal collateral branches without extensive retraction. Furthermore, its trajectory is directly along the dorsum and diaphragm sellae, thus allowing for the direct oversight of tumor posteroinferior extension[12,13].

Likewise, through the contralateral Subfrontal route, manipulation of the optic nerve is reduced and the inferomedial aspect of the compromised optic nerve is visualized, which could result in improved postoperative visual results (Jangy col. 2012)[6,7,8]. Likewise, the unilateral subfrontal pathway, via both supraorbital and frontal approaches, attains a broader view over the planum sphenoidale and tuberculum sellae than a transsylvian corridor [12].

Authors such as Alekseev et al, (2017) chose the transciliary supraorbital approach, for which it is suitable for the extirpation of tumors in the sellar region, under the appropriate selection of patients, since it provides an adequate view of the anatomical structures and allows a successful tumor resection through a less traumatic approach [9,12]. Similarly, Alhadi et al. performed endoscope-assisted minimally invasive surgery through a transcilillary incision for the excision of large anterior and middle cranial fossa meningiomas (large anterior cranial fossa meningiomas (diameter >5 cm) extending to the middle fossa in four), further suggest that with the use of modern and newly designed equipment, complete resection of large anterior and middle fossa meningiomas can be performed with the same safety, efficiency, and with lower complication rates [14].

Anterolateral corridors harbor several advantages: the possibility of harnessing both subfrontal and transsylvian routes, frontal sinus sparing; early visualization and access to the optic chiasm and ipsi/contralateral crucial neurovascular structures, the early opening of arachnoid cisterns and brain relaxation; a low rate of cerebral edema. Contrariwise, some series reported an inadequate control of tumor extending in the ipsilateral optic canal and inferior surface of the chiasm, triggering post-operative visual deterioration, which is a major concern [12].

Arifin et al (2012), prefer a pterional approach with opening of the Sylvian fissure to drain the cerebrospinal fluid (CSF) and improve access to the tumor area, ensuring the maximum safe resection of the lesion, and the lowest trans-surgical risk [8 ].

As reported by Romani et al. the lateral supraorbital approach, as well as the similar frontolateral approach, can provide the same advantages of pterional and frontoorbitozygomatic craniotomies without exposing the middle fossa. Anterolateral approaches provide the shortest distance to the sellar region and the tumors that arise in it. Therefore, they have been considered to be tailored to sella turcica meningiomas with lateral and posterior spread [12].

The rationale for the adoption of extended transplanum-transtubercle endonasal approaches (ESA) for the treatment of meningiomas of the sphenoid plane/sellar tubercle is mainly based on the possibility of better treatment of the internal tumor, in addition it allows adapting bone removal on antero-posterior and lateral tumor extension and a customized 160° to 180° inferomedial optic canal decompression. Divitiis et al suggested the use of ESA for the treatment of small to medium-sized tumors without lateral extension beyond the supraclinoid internal carotid arteries and optic nerves, with limited dural junction, without vascular lining, and without calcifications[12]. Likewise Ogawa and Tominaga, 2012 state that the ideal way to perform the excision of these lesions is the extended Transsphenoidal endoscopic approach, which has a potential equivalent to transcranial surgery for meningiomas with a maximum diameter of less than 30 mm plus tumors with lateral extension towards the internal carotid artery are less likely to be removed completely [15]. Authors also suggest that because the dural feeding branches of McConnell and the posterior ethmoid arteries follow their course from below, tumor devascularization can be performed more effectively through the transplanum-transtubercle extended endonasal route, being similarly a relatively less invasive procedure with faster postoperative recovery and shorter hospital stay[2,5].

According to Mortazavi, Sekhar, and colleagues, a patient with a tumor < 2 cm, no or minimal vascular lining, and minimal extension into the optic canals can undergo endoscopic transsphenoidal resection, whereas a patient with brain invasion, vascular lining > 180°, size >4 cm, and severe involvement of the optic canal is more suitable for the transcranial approach. Another situation in which an endoscopic endonasal approach may be advantageous is when the tumor extends down into the sella turcica or sphenoid sinus. Access to this region is extremely difficult with transcranial approaches. However, a greater anterior extension of the exposure at the base of the skull may risk injuring the olfactory nerves and tracts and thus should be avoided if the patient's sense of smell is intact. In such cases, we consider an alternative approach such as minimally invasive supraorbital craniotomy [5].

Transcranial corridors had higher rates of gross total resection (GTR) (up to 94%) and lower rates of anosmia (9.4%) and cerebrospinal fluid (CSF) leak (up to 6.4%) compared with approaches endoscopic endonasal pathways (up to 70.3%, 95.9% and 22%), respectively, while the transsphenoidal approach allows high rates of visual improvement, because it allows early visualization of the optic nerves and neurovascular structures, thus allowing direct decompression of optic nerves, although with significant risk of cerebrospinal fluid leak and anosmia [3,5,12].

Transcranial approaches are best suited for tumors that extend beyond the polygon entangled by the supraclinoid ICAs and optic nerves and chiasm, harbor a firm or calcified consistency, and have superolateral invasion of the optic canals. Several surgical series, systematic reviews, and meta-analyses have revealed that the endoscopic endonasal approach and the transcranial approaches provide similar rates of neurologic, endocrinologic complications, while the endoscopic endonasal approach is associated with greater improvement in visual function and, conversely, higher rates of CSF leak [5,12]. Graffeo et al. Reported lower recurrence rates for transcranial approaches [101], whereas Muskens et al. described higher rates of vascular injury for EEA [12].

It is important to highlight that visual disturbance is the most relevant symptom and guaranteeing early release of the optic nerve is crucial in the event of any unforeseen interruption of surgery (either for anesthetic or cardiological reasons, etc.), therefore performing an early optic foraminotomy , included in the pterional route, is an ideal method [3].

Stains such as indocyanine green have been used with good results when guiding surgery, greatly limiting the edges of the lesion, achieving maximum safe resection [2,6].

## Conclusion

The patient in the following publication was approached through a transcranial, pterional approach with a Transylvian corridor that allowed total resection of the lesion with Simpson grade 1, respecting the neuro-vascular structures in the area, whose only trans-surgical complication was a a mild contusion in the small frontal cortex without any clinical repercussions, with rapid improvement of the symptoms postoperative. Therefore, there was significant results due to this approach. However, we do not disagree on the use of the extended transplanum-transtubercle endoscopic endonasal route. It is agreed that it is of vital importance to assess the idiosyncratic characteristics of each patient when taking a the surgical decision on the type of approach for tubercle sellar meningiomas, taking into account the relationship of its tumor lesion with adjacent structures, its size, and consistency. The reason for which it was decided to carry out this publication is with the purpose that the findings obtained in the management of this case serves others in their decision-making regarding patients affected by this pathology.

## Conflicts of Interest

The authors declare no conflict of interests.

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