Case report

Full endoscopic endonasal transclival approach: Meningioma attached to the ventral surface of the brainstem

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ABSTRACT

Background: Intracranial meningiomas without dural attachment (MWODA) are rare entities. We present the first case published, to the best of our knowledge, regarding a MWODA attached to the ventral surface of the brainstem. This location makes the patient subsidiary to treatment through an expanded endonasal transclival approach.

Clinical presentation: A 16-year-old female with suspected diagnosis of recurrence of a clear cell meningioma (CCM) at a distance from the initial lesion, located on the premedullary cistern. The patient underwent a pure endoscopic low transclival approach. The attachment to the ventral surface of the brainstem was confirmed intraoperatively. Postoperative MRI confirmed gross total resection and treatment was complemented with adjuvant fractionated stereotactic radiotherapy. No complications related to the procedure were observed.

Conclusion: MWODA may appear attached to the ventral brainstem. The expanded endonasal approach to the clivus provides a critical anatomical advantage in the treatment of medial lesions, even ventral meningiomas, to the lower cranial nerves. Reconstruction principles must be strictly respected to reduce complications.

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Abordaje endonasal transclival: Meningioma implantado en la superficie ventral del tronco cerebral

RESUMEN

Introducción: Los meningiomas sin implantación dural MSID son una rara entidad. Presentamos el primer caso publicado en nuestro conocimiento, de MSID implantado en la superficie ventral del tronco cerebral. Dicha localización permite la realización de un abordaje quirúrgico endonasal expandido transclival para su tratamiento.

Caso clínico: Paciente mujer de 16 años con la sospecha de presentar una recurrencia de meningioma de células claras localizada en la cisterna prebulbar a distancia de la lesión.
Background

Intracranial meningiomas without dural attachment (MWODA), except in ventricular location, are a rare entity, even much less frequent in posterior fossa. To date only nine infratentorial cases have been reported. This is, in our knowledge, the first case published about MWODA with attachment to the ventral surface of the brainstem.

This location, in the ventral cranial base corridor, makes this tumor subsity to be approached by transclival expanded endonasal approach because it minimizes the brain retraction and prevents manipulation of the cranial nerves and vertebrobasilar arterial system.

Case report

A 16-year-old female was operated on five years ago via the suboccipital approach to treat a large posterior fossa clear cell meningioma without dural attachment (MWODA), located in the right cerebellomedullary cistern. The patient recovered uneventfully after this operation, and the immediate postoperative magnetic resonance imaging (MRI) showed no residual tumor. MRI was indicated at regular annual intervals.

After five years, follow-up MRI disclosed the presence of a 15-mm, contrast-enhancing tumor on the right premedullary cistern (Fig. 1). The initial diagnosis was clear cell meningioma (CCM) recurrence. Taking into account the patient’s age and the tumor features, the patient underwent surgical treatment via the full endoscopic low transclival expanded endonasal approach.

Surgical procedure

A Medtronic® neuronavigation system was employed with multi-slice CT images with contrast. Under general anesthesia and evoked potential monitoring, the patient was placed in a supine position, with her neck stretched and head turned 10° sideways toward the left shoulder, slightly turned rightward and held in place with a Mayfield cephalostat. Povidone-iodine was applied to the perinasal and the anterolateral region of the right thigh in case fascia lata or fat graft extraction was required during the final reconstruction work. After this step, cottonoids soaked with 1% tetracaine chlorhydrate solution and 0.1% adrenaline were introduced through both nostrils and positioned at the middle meatus and paraseptal positions, medially at the inferior and mid turbinates, for approximately 15 minutes. The endonasal procedure was performed using a Karl Storz® O rigid endoscope and an Endo-Scrub 2 lens cleaning sheath (Medtronic®). Right mid-turbinectomy was done on the left side. The mid-contralateral concha was fractured and dislocated laterally and at this stage, the nasoseptal flap (NSF) was raised on the right side following the technique defined by Hadad and Bassagasteguy. The posterior half of the septum was dissected to enable work using both nostrils and four hands. Then, sphenoidotomy was performed, taking away the sphenoid floor all the way to the clival recess using a diamond drill with a Midas Rex® motor.

Next, an inferiorly based U-shaped flap in the rhinopharyngeal mucosa was prepared to expose the lower clivus and foramen magnum. An inverted-U shaped incision was made at the rhinopharynx level, while the rhinopharyngeal mucosa, the basipharyngeal fascia, and the rectus capitis muscles were inferiorly rejected in bloc, which is dissected from the inferior clivus and the cranio cervical junction. It is necessary to bear in mind the dense and consistent setting of these tissues at the skull base that makes this stage quite tedious. Then the lower clivus was drilled to expose underlying dura which was opened with a right-based C-shaped flap. After dural opening, the meningioma was directly observed, its manipulation revealed firm attachment to the ventral brainstem (video) and after endoscopic dissection, the tumor was resected in two pieces, avoiding the arterial vertebrobasilar system and lower cranial nerves injury. Closure was performed with fat graft inlay and fascia lata onlay, then the U-inverted rhinopharyngeal flap was placed inferiorly and the nasoseptal flap superiorly. Fibrin sealant (Duraseal®) was applied. Finally we used a 12 French Foley balloon above the soft palate to support the vascularized reconstruction and a lumbar external drainage with a drainage rhythm of about 5-10ml/h that were removed 3 days after the procedure.

Postoperative course

The postoperative course was uneventful. The patient tolerated early extubation and oral feeding. Postoperative MRI confirmed gross total resection (Fig. 2) and histological diagnosis resulted in clear cell meningioma. Treatment was complemented with adjuvant fractionated stereotactic radiotherapy.
Fig. 1 – Preoperative images. (A) Axial CT scan evidenced the close relationship between the tumor and the ventral surface of the brainstem. (B) Coronal CT scan shows the relationship between the tumor and (white head arrow) the hypoglossal canal (black head arrow). (C) Sagittal MRI with contrast defined the relationship between the tumor and the right vertebral artery. (D) Axial MRI with contrast corroborated the tumoral attachment to the ventral surface of the brainstem.

Fig. 2 – Postoperative images. (A) Axial with contrast MRI shows the complete removal and the vascularized reconstruction (white arrow). (B) Sagittal with contrast MRI corroborates the gross total removal and the vascularized reconstruction, superiorly with the nasoseptal flap (white arrow) and inferiorly with the U-inverted rhinopharyngeal mucosa flap (white head arrow).

After an 18-month follow-up, the patient remains asymptomatic and MRI shows no tumoral recurrence.

Discussion

Although meningiomas without dural attachment have a very uncommon presentation, they have been described since the early twentieth century. The presence of arachnoid cap cells in arachnoidal, pial layers or in other ectopic locations distinct from the dura mater may account for these rare cases. Except those in the ventricular location, infratentorial MWODA is an exceptional entity. To date, excluding the present case, only nine infratentorial cases have been reported as found from review of the available English literature. Three cases involved in the cerebellomedullary cistern, two magnum cistern, two intraparenchymal meningiomas of the brainstem, one cerebellopontine angle and one cerebellar cortex (Table 1). The present case is, to the best of our knowledge, the first published case of MWODA with ventral attachment to the brainstem. This finding was clearly confirmed intraoperatively due to the selected approach (video).

CCMs are one of the rarest histological forms, representing 0.2% of all meningiomas. They are classified as grade II malignancies according to the World Health Organization (WHO) classification of central nervous system (CNS) tumors for their aggressiveness and higher rates of recurrence. In recent studies, the recurrence rate is from 22 to 61%. Even patients treated with gross total resection (GTR) have a recurrence rate of approximately 50%. Considering the high rate
of local recurrence and the uncertain capacity for metastasis, the neuraxis should be imaged with MRI after the initial diagnosis and at regular yearly intervals for at least five years. Some authors\textsuperscript{10} consider the treatment of choice for CCM to be complete resection without adjuvant treatment; however, recent publications have recommended the use of surgery plus radiotherapy (RT) even if GTR is achieved. In fact, in 2013, the National Comprehensive Cancer Network guidelines recommended consideration of postoperative RT for patients with WHO grade II tumors and referral of all patients with WHO grade III tumors for postoperative RT.\textsuperscript{11}

With respect to the current case, the patient did not receive RT after the first surgery because of her age and the GTR of the tumor. After recurrence, the medical team decided to perform a new surgical procedure with adjuvant fractionated stereotactic RT because the patient's age is the main factor for tumor regrowth after treatment with RT alone.

Posterior cranial base meningiomas and craniocervical junction meningiomas represent challenging lesions for the surgeon because of the closeness of the brainstem, the cranial nerves, and the verteobasilar arteries. The surgical approaches to the clivus used are broadly classified as anterior midline and lateral approaches. Anterior midline approaches consist of extended subfrontal, transmaxillary, transmandibular, transsphenoidal, endoscopic endonasal, transoral, and transcervical approaches. Lateral open skull base approaches include frontotemporal transcavous transorbitozygomatic, anterior transpetrosal, preauricular infratemporal, combined supratentorial and infratentorial transtemporal, and extreme lateral transcervical approaches. Combined or staged surgeries are often necessary, depending on the size and anatomic distribution of the tumor.\textsuperscript{12} Despite recent improvements in minimally invasive surgery and technological advances, treatment of tumors in this location still carries a high morbidity.\textsuperscript{13,14} In the current case, the patient underwent a full endoscopic, lower transclival, expanded endonasal approach. The superior limit of this approach was the sphenoidal floor, the inferior limit was the foramen magnum, and the lateral limits were the occipital condyles and jugular tubercles. This approach allows the premedullary cistern to be reached directly without manipulating the lower cranial nerves, which are located laterally to the tumor, and without retracting the brain parenchyma. In addition, it allows for bimanual manipulation and sharp dissection of the attachment to structures, such as the brainstem.

In summary, the expanded endonasal approach to the clivus provides a critical anatomical advantage to treat medial lesions to the lower cranial nerves.\textsuperscript{15} Cerebrospinal fluid (CSF) leakage is the most common major complication of the expanded endonasal approach when treating intradural lesions.\textsuperscript{16} Therefore, reconstruction principles must be strictly respected to reduce CSF leakage from high flow to low flow,\textsuperscript{17} by placing fat grafts or fascia lata grafts, and by using vascularized flaps that have been shown to be more effective than multilayer reconstructions.\textsuperscript{18}

### Conclusion

The expanded endonasal approach to the clivus provides a critical anatomical advantage to treat medial lesions, even ventral meningiomas, to the lower cranial nerves. Reconstruction principles must be strictly respected to reduce CSF leakage. Databases are necessary to establish the real frequency of the MWODA.

### Conflict of interest

The authors declare no conflict of interest.

### Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.neucir.2013.10.003.

### References


### Table 1: Published infratentorial meningiomas without dural attachment.

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