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Surgical Neurology International

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SNI: Skull Base

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Video Abstract

Endoscopic transnasal resection of an anterior planum sphenoidale meningioma

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Received : 21 March 2020
Accepted : 09 April 2020
Published : 02 May 2020

DOI
10.25259/SNI_116_2020

Quick Response Code:

ABSTRACT

Background: Planum sphenoidale meningiomas comprise about 2% of all primary intracranial tumors. More often, they carry a significant surgical challenge due to their relation to the surrounding vital neurovascular structures. Endoscopic endonasal approach to such tumors holds multiple advantages to the transcranial counterpart in terms of coagulating the vascular supply, minimal brain retraction, and the ability to fully expose the tumor with the affected dura.

Case Description: In this surgical video, we are presenting a case of a 28-year-old male, who presented to our hospital after he had one episode of a generalized tonic-clonic seizure that was controlled with an antiepileptic medication. Neurological examination was unremarkable including optic and olfactory nerves. Magnetic resonance imaging (MRI) showed a large anterior skull base mass located at the planum sphenoidale anteriorly. The patient underwent an endoscopic transnasal approach, drilling of the planum sphenoidale, and *en bloc* total resection of the tumor. In the follow-up office visit, the patient had no more seizures with preserved olfaction; MRI revealed no tumor residual.

Conclusion: Planum sphenoidale meningiomas are surgically challenging due to its close proximity to important structures, such as pituitary gland, internal carotid arteries, and optic chiasm. Respecting the arachnoid plane and generous coagulation of vascular supply from the ethmoid arteries facilitate safe removal.

Keywords: Expanded endoscopic endonasal approach, Meningioma, Minimally invasive, Planum sphenoidale meningioma

[Video 1]-Available on:
www.surgicalneurologyint.com

Annotations[1-6]

This video is a demonstration of an endoscopic trans-nasal approach for an anterior planum sphenoidale meningioma. Our patient is a 28-year-old male who is medically free; he presented with a generalized tonic-clonic seizure that was controlled with a single antiepileptic agent (00:14). CT (Computed Tomography) and MRI of the brain imaging showed a heavily calcified anterior planum sphenoidale meningioma with mild extension to the cribriform plate. The patient was admitted for an elective surgical excision. Thin cuts CT scan was used for neuro-navigation and registration, this was then merged with an MRI T1 with contrast. The procedure is planned and done in the operative suite in collaboration with the rhinology team.

The purpose of the procedure is to prevent further seizure episodes and future growth of the tumor and its associated neurological deficits (00:37). Common risks associated with the procedure is cerebrospinal fluid leak (CSF) (00:50). An alternative approach is fronto-temporal craniotomy and trans-cranial approach (00:55). After intubation, under sterile techniques, a lumbar drain was inserted(01:09). Then utilizing a supine position, the head was fixed using a head clamp with mild rotation to the right side and mild head tilt to the left side. The thigh was prepped for a fascia lata harvest. Necessary equipment is endoscope camera, long shaft endoscopic drill, single shaft endoscope bipolar, and single shaft endoscope scissor (01:28). After irrigation of the nasal cavity, lateralization of the middle and inferior turbinate was performed for a better working space. Then wide and long nasal septal flap was harvested to ensure that the full skull base defect is covered during the reconstruction (01:41). The septal flap is then placed in the nasopharynx.

Posterior septostomy is performed to allow bilateral manoeuvring of the instruments. The septostomy included the bony attachment to the anterior sphenoid wall and posterior ethmoidal sinus (02:06). Bilateral superior turbinates are the removed. Then we proceed with opening of the sphenoid sinus andthe posterior ethmoidal sinuses bilaterally (02:15). Neuro-navigation is used to plan the most anterior and lateral opening of the skull base (02:20). The procedure is tailored to allow maximum exposure of the tumor, at the same time to maximize the chance for olfaction preservation post-operatively. We are performing more exposure on the right side of the sinus, to allow for post-operative preservation of olfactory rootlets and nasal mucosa contralaterally (02:35). The posterior ethmoidal arteries are localized bilaterally, which is few mm anterior to the anterior sphenoid wall (02:47). Neuro-navigation can help to localize the anterior and posterior ethmoidal arteries.

Localization of the posterior ethmoidal arteries are of extreme importance in this case for better hemostasis and control of tumor feeders (02:59). After complete exposure of the sphenoid sinus and posterior ethmoidal sinuses, the sinus mucosa is removed. It's important to remove all the sinus mucosa to allow better healing of the septal flap and attachment later on during the reconstruction (03:14). A high-speed drill using a cutting burr (4 and 3 mm in size) are utilized during the opening. It's important to note that removing the sinus septations during the exposure will certainly help in manipulating the instruments during surgery (03:29). Removing the septations is also important to prevent bridging and gaping during the placement of the septal flap during the reconstruction (03:36).

After complete removal of the posterior ethmoidal air cells and a small part of the posterior aspect of the anterior ethmoidal air cells, the planum sphenoidale is exposed on the right side (03:44). Then we represent the lateral limits of this exposure (03:59). The anterior limit is planned with the help of neuro-navigation, to tailor the approach for a better exposure. Posteriorly, the anterior sellar aspect is drilled to expose the dura of the sella and the chiasmatic sulcus (04:09). Once we reach the full exposure of the planned dural opening, which is a v-shaped bony opening, then we proceed with coagulating the dura to control the feeders and also to coagulate the posterior ethmoidal arteries if localized (04:16). In this case, the right posterior ethmoidal artery is localized and coagulated. The dural opening was performed using a diamond knife (04:38). Once the dura is opened, it can be removed or kept attached to the tumor during the resection.

We start exposing the tumor posteriorly, without opening the dura of the sella, just superior to the diaphragma sella (04:47). It's important to define the plane between the tumor and the arachnoid which will act as a barrier during the surgical resection of the tumor and to protect the normal structures (04:54). It's easier to start with the posterior attachment of the tumor to the dura and localize the arachnoid planes from that point anteriorly around the base of the lesion (05:05). This surgery is planned with more aggressive resection on the right side in an attempt to preserve olfaction on the left side. The left olfactory bulb is visualized and the arachnoid plane is dissected between the tumor and the olfactory bulb, such dissection can be difficult in these cases (05:20). Once the arachnoid planes are established around the base of the tumor, then central debulking can be performed to promote smooth dissection (05:30).

Central debulking can be done using ultrasonic aspirator, sharp dissection, or pituitary punch (05:38). The easiest and most straightforward part of the dissection is the posterior attachment of the tumor (05:44). For better retraction of the tumor and to allow four hands technique, we use a 4-0 Vicryl stitch to help traction of the tumor (05:50). The assistant surgeon holding the scope is using the stitched vicryl for traction which will help the primary surgeon to dissect the tumor using 2 instruments (05:59). We prefer using small suctions and Rhoton dissectors at this stage. Using this 4 hands technique, continuous manipulation of the tumor with traction will help establishing more arachnoid planes around the tumor (06:13) Here we can see the normal posterior cranial structures including the pituitary stalk (06:21). Once the arachnoid plane around the tumor base is established, a more aggressive traction can be performed. More central debulking is done to allow an easier and safer dissection (06:27). During the resection, the left posterior ethmoidal artery was localized, coagulated, and separated from the tumor (06:40).

We use the AQUAMENTYS™ (Medtronic Inc, Dublinc, Ireland) to control the bleeding within the tumor, endoscopic bipolars can also be used (06:48). Once the tumor is shrinked and the arachnoid planes are established around the base and sides of the lesion, more attraction can be applied. It's important to maintain the arachnoid plane during the procedure. Central debulking is done to facilitate tumor traction and then the residual tumor is pulled in one piece (07:09). As you can see in the image, the arachnoid plane is maintained around the dome of the tumor (07:20). After removing the tumor and inspecting the surfaces, further inspection is done to remove remnant residual tumor (07:24).

Full inspection of the tumor and surgical cavity is done to ensure complete resection and hemostasis, then reconstruction can be performed. We used the fat graft, obtained from the thigh to fill the cavity (07:34). After the fat placement, we visualized and noticed an empty space in the anterior side of the cavity. Therefore, further packing with fat is done using SURGICEL® (J&J Medical Inc, Birdsboro, PA) to support the fat from falling (07:55). Making sure the anterior cavity is packed with fat is important because this is a usual site for poetoperative CSF leak (08:01). The fascia lata and MEDPOR (Stryker, Kalamazoo, MI) are both used for further reconstruction. Gasket Seal technique is used to support the construct (08:14). We stitch the fascia lata to the MEDPOR (Stryker Co, Kalamazoo, MI) as shown in the images for easier manipulation (08:18). Once the reconstruct is fixed in place, the fascia is folded centrally away from the bony edges to allow for a maximum surface attachment of the septal flap to the bone (08:24). Then we use SURGICEL® (J&J Medical Inc, Birdsboro, PA) to hold the folds in place, we try to avoid any type of tissue between the bone and the flap (08:35). Then the septal flap is positioned with direct attachment of the septal flap to the exposed bone with no septations or bridging (08:42). The septal flap edge is supported with SURGICEL® (J&J Medical Inc, Birdsboro, PA) and surgical glue, in this case TISSEEL (Baxter International Inc, Deerfield, Illinois) (08:51). Gelfoam is used to fill the sphenoid sinus cavity and to keep the flap in place. This is supported by two bilateral nasal packings using MEROCEL® (Medtronic Inc, Dublinc, Ireland) (09:01).

This is the immediate post-operative imaging, the CT scan showed the surgical bony defect and the MRI showed complete excision of the tumor and resolution of the left frontal edema (09:17) The fat sat delineates the differentiation between fat and residual tumor (09:27). Both anterior communicating arteries are intact in the post-operative imaging. The patient was evaluated 2 months after surgery with no neurological deficits or CSF leak, with the preservation of olfaction bilaterally with mild impairment (09:38).

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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How to cite this article: Elarjani T, Khairy S, Alsaleh S, Ajlan A. Endoscopic transnasal resection of an anterior planum sphenoidale meningioma. Surg Neurol Int 2020;11:93.