Intracavernous Epidermoid Tumor Presenting with Abducens Nerve Paresis

—Case Report—

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Abstract

An unusual case of a pediatric epidermoid tumor entirely located in the cavernous sinus is reported. A 6-year-old boy presented with left abducens nerve paresis which developed over 2 months. Neuroimaging demonstrated a lesion in the left cavernous sinus. Part of the tumor capsule and the pearly contents were removed by the left pterional approach through Dolenc's anterolateral triangle. No bleeding from the cavernous sinus occurred. The tumor was histologically identified as an epidermoid tumor. Postoperatively, the abducens nerve paresis improved. The presence of dural reflection in the lateral wall of the cavernous sinus and displacement of the intracavernous internal carotid artery are useful indicators for intracavernous lesions.

Key words: epidermoid tumor, cavernous sinus, gadolinium, magnetic resonance imaging, abducens nerve paresis

Introduction

Tumors rarely originate primarily within the cavernous sinus. Intracavernous primary lesions are aneurysms in 80% of cases, meningiomas in 10%, and neurofibromas in 10%, while pituitary tumors account for less than 1%. Only 0.1–0.2% of intracranial tumors involve the cavernous sinus.¹⁵⁾ Epidermoid tumor is relatively rare in childhood (0.5% of all pediatric intracranial tumors, 6.4% of all epidermoid tumors).⁴⁾ Epidermoid tumors occur in three regions: retrosellar, supra- or parasellar, and intraventricular.¹¹⁾ Usually, parasellar tumors originate in the middle fossa and extend laterally, producing clinical syndromes related to the temporal lobe or Sylvian region.¹⁴⁾ Occasionally, epidermoid tumors originate in the paratrigeminal region including Meckel's cave,^{3,12)} and extend extradurally along the petrous ridge into the middle fossa under the Gasserian ganglion, initially affecting the trigeminal nerve, but ultimately involving the optic, oculomotor, trochlear, abducens, facial, and

acoustic nerves. However, no epidermoid tumor entirely within the cavernous sinus has been reported.

Here, we report an unusual intracavernous epidermoid tumor and discuss the microanatomical relationship between the tumor and the cavernous sinus.

Case Report

A 6-year-old boy presented with limited lateral eye movement on the left which gradually progressed over 2 months. Neurological examination found moderate left abducens nerve paresis but no other cranial nerve involvement.

Precontrast axial computed tomographic (CT) scans disclosed an oval-shaped mass isodense with cerebrospinal fluid in the parasellar region. No calcification was apparent. The anterolateral margin of the tumor was enhanced on postcontrast scans. The tumor was appeared to be located between the cavernous sinus and the medial aspect of the left temporal lobe on the coronal scan (Fig. 1). The tumor extended to the foramen ovale laterally, and to

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Fig. 1 Postcontrast coronal CT scan, showing a hypodense mass in the left parasellar region, extending to the foramen ovale laterally and elevating the medial aspect of the temporal lobe superiorly. The enhanced cavernous sinus is compressed medially to the sella turcica.

the petrous apex posteriorly where slight bone erosion was observed. T₁-weighted magnetic resonance (MR) images revealed a hypointense mass in the left cavernous sinus (Fig. 2 *left*). T₂-weighted images showed a homogeneous hyperintense lesion closely attached to the intracavernous part of the internal carotid artery (ICA) (Fig. 2 *center*). The tumor was slightly hyperintense compared to cerebrospinal

fluid on the proton density images. T₁-weighted images with gadolinium-diethylenetriaminepenta-acetic acid (Gd-DTPA) disclosed enhancement of the tumor margin (Fig. 2 *right*). The tumor apparently occupied the middle part of the left cavernous sinus and extended to the petrous apex and Meckel's cave, but not the suprasellar cistern, sella turcica, or temporal lobe. Left internal carotid angiograms demonstrated no tumor stain. The intracavernous ICA was located normally without medial displacement or opening of the left carotid siphon. Selective external carotid angiograms showed the left cavernous sinus to be patent.

The intracapsular tumor and part of the lateral capsule were removed *via* the pterional approach (Fig. 3 *left*). The tumor did not extend intradurally. The dura was incised where the lateral wall of the cavernous sinus protruded. The tumor was removed through Dolenc's anterolateral triangle.⁵⁾ The first division of the left trigeminal nerve was identified just beneath the dural incision (Fig. 3 *right*). The thin tumor capsule was opened and the friable pearly contents were removed as far as possible with a curette. The intracavernous ICA and the venous pool could then be observed through the thin tumor capsule. It was, however, difficult to identify the left abducens nerve. The tumor extended to the left middle cranial fossa but not the dural entrance of the left oculomotor nerve superiorly. No bleeding from the cavernous sinus was encountered intraoperatively as the tumor capsule isolated the tumor from the

Fig. 2 *left*: T₁-weighted (TR 400/TE 20 msec) axial MR image, showing the mass as slightly hypointense relative to the brain. Meckel's cave is obliterated on the left. Note the normal appearance of Meckel's cave on the right (*arrow*). The left intracavernous ICA, shown as a flow void, is slightly displaced medially by the tumor. *center*: T₂-weighted (TR 2000/TE 30 msec) axial MR image, showing the tumor as a hyperintense lesion together with the cavernous sinus. A low-signal rim (*arrowheads*) represents a dural reflection forming the lateral cavernous sinus margin. *right*: Gadolinium-enhanced T₁-weighted axial MR image after Gd-DTPA administration, showing the cisternal portion of the trigeminal nerve (*arrow*) and the tumor invasion into Meckel's cave. The enhanced anterolateral margin is apparently the lateral wall (dural layer) of the cavernous sinus.

Fig. 3 *left*: Schematic drawing of the operative field (left pterional approach). There was no intradural tumor extension. The dura was incised where the lateral wall of the cavernous sinus protruded. ACP: anterior clinoid process, EP: epidermoid tumor, F: frontal lobe, ON: optic nerve, T: temporal lobe, III: oculomotor nerve, V₁: first division of the trigeminal nerve. *right*: Intraoperative view. The tumor was removed through Dolenc's anterolateral triangle. The first division of the left trigeminal nerve (arrows) was identified just beneath the dural incision. The tumor capsule was opened and the friable pearly contents removed.

Fig. 4 Photomicrograph of the tumor specimen, showing fragments of a stratified squamous epithelium on or in keratinous tissue without appendages. HE stain, $\times 100$.

venous pools.

Histological examination of the tumor specimen found keratinous lamellar material and fragments of a stratified squamous epithelium. The diagnosis was epidermoid tumor (Fig. 4).

He was discharged 2 weeks after surgery. Four months after surgery, the abducens nerve paresis gradually improved without additional neurological deficit. Follow-up MR images with Gd-DTPA showed that

Fig. 5 Pre- (*left*) and postoperative (*right*) gap-less T₁-weighted coronal MR images after Gd-DTPA administration. The bulging and the tumor septum had disappeared postoperatively.

the bulging of the lateral wall of the cavernous sinus and the tumor septum were absent (Fig. 5). The tumor cavity was replaced by cerebrospinal fluid.

Discussion

The clinical presentation and operative findings in this case are consistent with an epidermoid tumor located entirely within the cavernous sinus. The tumor compressed the lateral wall of the cavernous sinus laterally, the ICA medially, and extended into Meckel's cave.

There are 10 reported cases of epidermoid tumor originating in Meckel's cave and the paratrigeminal area.¹²⁾ All presented with trigeminal neuralgia or some degree of hypesthesia. In three cases, abducens nerve paresis with or without other cranial nerve dysfunctions was also present. Kline and Galbraith¹⁰⁾ reported a large extradural mass protruding laterally from the cavernous sinus with an intradural extension. The first symptom was abducens nerve paresis, but this disappeared spontaneously and was followed by painful ophthalmoplegia and the cavernous sinus syndrome.

Dolenc *et al.*⁶⁾ reported 63 intracavernous sinus tumors including two epidermoid tumors, but it is unclear whether these epidermoid tumors were any of the 15 intracavernous tumors originating in the cavernous sinus. This is therefore the first report of an epidermoid tumor located entirely within the cavernous sinus.

The origin and extent of parasellar tumors are sometimes difficult to define preoperatively, especially when the tumor is within the cavernous sinus. Recent microanatomical and MR imaging studies of the cavernous sinus have disclosed the detailed relation-

ships between the dural wall and the IIIrd-VIth cranial nerves, and the ICA. The presence of dural reflection in the lateral wall of the cavernous sinus and displacement of the intracavernous ICA are useful indicators for intracavernous lesions. Lateral dural reflection appears on postcontrast CT scans as a thin enhanced margin surrounding the tumor in 50% of cavernous lesions, and as a thin hypointense rim adjacent to the mass on T₁-weighted MR images in most cases.⁷⁾ Lateral displacement of the intracavernous ICA suggests the extension of a mass in the pituitary fossa. In contrast, medial displacement of the ICA and clear outward bulging of the lateral wall of the cavernous sinus suggest unequivocal localization of a mass within the cavernous sinus. Our case satisfied these conditions.

The microanatomy of the cavernous sinus is still controversial. Recent reports disclosed that the lateral wall of the cavernous sinus has two layers: a superficial dural layer, and a deep nerve sheath and reticular membrane.^{8,17)} The venous channel in the cavernous sinus is located between two layers of dura mater: the periosteal (endosteal) layer forming the floor and most of the medial wall, and the dural layer forming the roof, lateral wall, and the upper medial wall.^{5,9,13)} Al-Mefty and Smith¹⁾ reported that removal of benign intracavernous tumors caused hemorrhage from the venous plexus only during the latter stages because the tumor compresses the venous channels medially. In our case, the tumor was removed through Dolenc's anterolateral triangle. The first division of the trigeminal nerve was seen just beneath the dura mater and over the tumor. After removal of the tumor contents, the intracavernous ICA was observed through the inner tumor capsule.

Posteroinferiorly, the tumor may have invaded Meckel's cave elevating the first and second divisions of the trigeminal nerve and Gasserian ganglion superiorly. MR imaging revealed that Meckel's cave was obliterated. There were, however, no signs of trigeminal nerve dysfunction. The trigeminal nerve is thick and tough compared to the abducens nerve, and runs just beneath the dural layer unlike the abducens nerve, which together with the ICA runs in the venous channel. Sekhar *et al.*¹⁶⁾ reported that the abducens nerve is likely to be damaged by mass lesions or intracavernous operations because of the long intracavernous course. Therefore, abducens nerve dysfunction would occur earlier than trigeminal nerve paresis in the presence of direct compression by an epidermoid tumor causing inflammation in the surrounding tissue, or pulsatile compression from the intracavernous ICA.

Total removal of the tumor capsule is ideal because epidermoid tumors grow slowly at 1 cm per year.²⁾ In this case, however, we did not detach the tumor capsule from the cranial nerves to avoid a severe and irreversible abducens nerve dysfunction. The abducens nerve paresis partially recovered postoperatively without any other neurological dysfunction.

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