Lesions in Meckel’s cave: variable presentation and pathology

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A series of 12 patients with mass lesions arising from Meckel’s cave is presented. Patients’ age on presentation ranged from 13 months to 71 years. Nine of the 12 patients had symptoms referable to the fifth cranial nerve, but only three complained of facial pain. The 12 patients presented eight different pathological entities, including meningioma, lipoma, schwannoma, malignant melanotic schwannoma, arachnoid cyst, neurofibroma, epidermoid tumor, and chordoma. Computerized tomography and magnetic resonance imaging were most useful in localizing the lesion to Meckel’s cave. All 12 patients underwent a subtemporal approach to the lesion, and gross total removal was achieved in 11. Postoperative results were excellent with no increased neurological deficits seen 3 months postoperatively. Most patients had resolution of the cranial nerve deficits except for fifth nerve function, which was impaired in nine patients postoperatively. This series demonstrates that lesions in Meckel’s cave can have a varied and unusual presentation, as well as an assortment of pathology. Total removal of lesions in this area resulted in relief of symptoms in most patients, with minimum morbidity.

KEY WORDS □ Meckel’s cave □ facial pain □ gasserian ganglion □ trigeminal nerve

Tumors of Meckel’s cave represent less than 0.5% of all intracranial tumors. These tumors can be associated with a variety of symptoms, most often with dysfunction of the fifth cranial nerve. In an effort to gain more information about these lesions, we studied 12 such cases operated on between 1972 and 1986, representing eight different pathological states.

Summary of Cases

The patients included seven females and five males, with ages at presentation ranging from 13 months to 71 years. The pathological entities were: four meningiomas, one lipoma, two schwannomas, one malignant melanotic schwannoma, one arachnoid cyst, one neurofibroma, one chordoma, and one epidermoid tumor (Table 1). Nine patients presented with symptoms or signs of fifth nerve dysfunction, but trigeminal neuralgia was seen in only three. Seven patients had involvement of other cranial nerves including the sixth nerve in all seven, the fourth nerve in one, the seventh nerve in two, and the eighth nerve in two. Two patients manifested exophthalmos from ipsilateral compression on the cavernous sinus.

Early in the series, preoperative localization of the lesions was performed by polytomographic pneumocisternography and angiography. Later, computerized tomography (CT) was used in 10 patients and magnetic resonance imaging (MRI) in six; these methods proved most useful in localizing the lesions to the region of Meckel’s cave. In six patients the tumor was located only in Meckel’s cave, and in six others the mass extended into the cerebellopontine angle (CPA). It was only in cases where the tumor extended into the posterior fossa that the patients had an accompanying trigeminal neuralgia, presumably due to tumor abutting the trigeminal nerve root entry zone.

All 12 patients underwent a subtemporal intradural approach to the lesion, and total removal was achieved in 11. Postoperative results were excellent with no increased neurological deficits present 3 months after operation. In most patients the cranial nerve deficits resolved except for fifth nerve function, which was impaired postoperatively in nine patients (Table 1).

Representative Cases

Case 4

This 34-year-old man presented with a 7-year history of “foggy vision” in the right eye when exposed to cold weather. He had a complete right fifth nerve palsy. The right cornea was clear, but he developed corneal edema upon exposure to cold. Computerized tomography showed a 2 × 3-cm enhancing lesion in Meckel’s cave (Fig. 1). He underwent a right temporal craniotomy...
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TABLE 1

Clinical summary in 12 cases of Meckel’s cave lesions*

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Age (yrs),†</th>
<th>Chief Complaint</th>
<th>Duration of Symptoms &amp; Clinical Findings</th>
<th>Side, Site, &amp; Extent of Lesion</th>
<th>Diagnosis</th>
<th>Postop Course; Follow-Up Period &amp; Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50, F</td>
<td>facial pain (TN)</td>
<td>3 yrs: 5th n. paralysis</td>
<td>rt, Meckel’s cave into CPA</td>
<td>meningioma</td>
<td>tumor recurrence in 1 yr with tic pain; total resection + rhizotomy of 5th n.; 3 yrs: 5th n. paralysis</td>
</tr>
<tr>
<td>2</td>
<td>48, F</td>
<td>facial pain (TN)</td>
<td>1 yr: normal</td>
<td>lt, Meckel’s cave into CPA</td>
<td>meningioma</td>
<td>recurrence of TN 12 yrs postop; reopera- tion 15 yrs postop; 12 yrs: 5th, 7th, &amp; 8th n. paralysis</td>
</tr>
<tr>
<td>3</td>
<td>71, F</td>
<td>crawling sensation on face; double vision</td>
<td>7 yrs: 5th–8th n. paralysis</td>
<td>lt, Meckel’s cave into CPA</td>
<td>meningioma</td>
<td>1 yr: 5th &amp; 8th n. paralysis</td>
</tr>
<tr>
<td>4</td>
<td>34, M</td>
<td>foggy vision in rt eye in cold weather</td>
<td>7 yrs: 5th n. paralysis</td>
<td>rt, Meckel’s cave into CPA</td>
<td>meningioma</td>
<td>1 yr: 5th n. paralysis</td>
</tr>
<tr>
<td>5</td>
<td>65, F</td>
<td>double vision</td>
<td>1 yr: partial 5th &amp; 6th n. paralysis</td>
<td>lt, Meckel’s cave into CPA</td>
<td>neurofibroma</td>
<td>5 yrs: 5th &amp; 6th n. paralysis</td>
</tr>
<tr>
<td>6</td>
<td>68, M</td>
<td>difficulty chewing; double vision</td>
<td>2 mos: partial 4th–6th n. paralysis</td>
<td>rt, Meckel’s cave</td>
<td>schwannoma</td>
<td>1 yr: partial 5th n. paralysis</td>
</tr>
<tr>
<td>7</td>
<td>22, F</td>
<td>episodic numbness in face; episodic double vision</td>
<td>3 yrs: partial 5th &amp; 6th n. paralysis</td>
<td>lt, Meckel’s cave</td>
<td>schwannoma</td>
<td>1½ yrs: partial 5th n. paralysis</td>
</tr>
<tr>
<td>8</td>
<td>12, M</td>
<td>facial pain (TN); double vision</td>
<td>1 yr: 5th &amp; 6th n. paralysis</td>
<td>rt, Meckel’s cave into CPA</td>
<td>malignant melanotic schwannoma</td>
<td>irradiation 2 yrs postop; 9 yrs: 5th n. paralysis</td>
</tr>
<tr>
<td>9</td>
<td>61, F</td>
<td>decreased vision in lt eye; facial tingling &amp; numbness</td>
<td>3 yrs: 5th, 8th &amp; partial 7th n. paralysis</td>
<td>lt, Meckel’s cave into CPA</td>
<td>epidermoid tumor</td>
<td>2 yrs: 5th &amp; 8th n. paralysis</td>
</tr>
<tr>
<td>10</td>
<td>49, M</td>
<td>episodic double vision &amp; facial numbness</td>
<td>3 yrs: partial 6th n. paralysis</td>
<td>lt, Meckel’s cave</td>
<td>chordoma</td>
<td>6 mos: normal</td>
</tr>
<tr>
<td>11</td>
<td>13, F</td>
<td>exophthalmos</td>
<td>1 yr: partial 5th n. paralysis</td>
<td>rt, Meckel’s cave into CPA</td>
<td>lipoma</td>
<td>6 mos: normal</td>
</tr>
<tr>
<td>12</td>
<td>1½, M</td>
<td>exophthalmos; double vision</td>
<td>1 yr: partial 5th &amp; 6th n. paralysis</td>
<td>rt, Meckel’s cave</td>
<td>arachnoid cyst</td>
<td>6 yrs: normal</td>
</tr>
</tbody>
</table>

* Abbreviations: n. = nerve; TN = trigeminal neuralgia; CPA = cerebellopontine angle.
† Age at presentation.

with total removal of a meningioma arising from the dura propria. Postoperatively, he did well but continues to have a complete fifth nerve palsy. His symptoms of foggy vision in cold weather persisted at examination 1 year after surgery.

Case 7

This 22-year-old woman presented with a 3-year history of episodic numbness in the left side of her face and episodic double vision. Physical examination revealed a partial paresis of the fifth nerve (first and second divisions) and of the sixth nerve. Computerized tomography revealed a 2 × 3-cm enhancing lesion in Meckel’s cave on the left (Fig. 2). The margins of the lesion were indistinct, and it was not clear whether the lesion was intradural or extradural. Axial T1-weighted MRI showed a high signal in the region of Meckel’s cave, and coronal T2-weighted MRI showed a distinct margin between the lesion and the temporal lobe, strongly suggesting that the lesion was extradural (Fig. 3). The patient underwent a left temporal craniotomy with total removal of a schwannoma. The tumor was an encapsulated mass that was extradural and separate from the dura but was densely attached to fibers of the fifth cranial nerve. Postoperatively, she did well but continues to have a partial fifth nerve dysfunction.

FIG. 1. Case 4. Computerized tomography scan with contrast infusion showing a 2 × 3-cm lesion (arrow) in Meckel’s cave. The pathology was meningioma.

FIG. 2. Case 7. Computerized tomography scan with contrast infusion showing a 2 × 3-cm lesion (arrow) in Meckel’s cave. The pathology was meningioma.
involving the first and second divisions. The sixth nerve paresis had resolved by 1.5 years after surgery.

Case 9

This 61-year-old woman presented with a 3-year history of decreased vision in the left eye and facial tingling and numbness. She had been deaf in the left ear for 3 years. She had a trigeminal nerve palsy, hearing loss, and mild droop on the left side of the face. Corneal ulceration was present in the left eye with corneal opacification. She underwent a left tarsorrhaphy. Following this, a CT scan revealed a hypodense nonenhancing lesion in the left temporal fossa with erosion of the petrous bone (Fig. 4 left). Axial T₂-weighted MRI revealed a well-defined lesion in Meckel’s cave (Fig. 4 right). The patient underwent a left temporal craniotomy and a subtemporal intradural approach to the tumor. The tumor extended from the superior orbital fissure into Meckel’s cave and down to the CPA. The mass was well encapsulated and total removal was achieved, leaving only remnants of capsule adherent to the fifth cranial nerve. Pathological examination revealed the tumor to be an epidermoid cyst.

Case 10

This 49-year-old man presented with a 3-year history of intermittent numbness in the left side of the face. In the previous year he developed double vision on left lateral gaze. On preoperative examination he had a mild left sixth nerve paresis; fifth nerve function was
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Fig. 5. Case 10. Computerized tomography scan with contrast infusion showing slight erosion of the petrous apex (arrow) in the region of Meckel's cave.

intact. A CT scan with infusion of contrast material revealed erosion of the petrous apex, but no distinct mass was seen (Fig. 5). Coronal T₁-weighted MRI demonstrated a low-intensity signal in the region of Meckel's cave, and axial T₁-weighted MRI revealed a high-intensity signal in the same region (Fig. 6). A left temporal craniotomy revealed a distinct bulge in the medial portion of the middle fossa floor. The dura was opened directly over this bulge in a direction parallel to the fifth nerve fibers. A gelatinous mass was encountered that could be aspirated, and gross total removal was achieved. The histological diagnosis was chordoma. Three months postoperatively the diplopia resolved; the fifth nerve function remained normal.

Case 11

This 13-year-old girl presented with a 1-year history of increasing exophthalmos in the right eye. Her physical examination was normal except for the right eye condition and a very subtle sensory loss in the right ophthalmic and maxillary distribution of the trigeminal nerve. A CT scan revealed a hypodense lesion in Meckel's cave extending caudally into the CPA; it also showed a very distended ophthalmic vein, presumably secondary to pressure on the cavernous sinus from the mass (Fig. 7 left). Coronal T₁-weighted MRI showed a high-intensity signal in the region of Meckel's cave (Fig 7 right). The mass was approached via a subtemporal intradural route. When the dura over the trigeminal nerve was opened, a large mass with the consistency of adipose tissue bulged out. Interpretation of a frozen-section biopsy indicated neural tissue with lipoma. The dural opening was extended along the floor of the temporal fossa parallel to the direction of the trigeminal nerve fibers in order to decompress the entire area of Meckel's cave. Only subtotal removal of the tumor was achieved because fibers of the fifth cranial nerve ran through the mass. The final pathological diagnosis was lipoma. Six months postoperatively, the exophthalmos had resolved; presumably opening the dura had relieved the pressure on the ipsilateral cavernous sinus. The fifth nerve function returned to normal.

Discussion

The most common tumors in Meckel's cave are neurinomas and meningiomas, but this area is the site of many other types of pathological lesions. Besides the eight entities reported in this series (Table 1), metastatic carcinomas, sarcomas, Cysticercus cysts, aneurysms, arteriovenous malformations, and amyloidomas have been reported in the region of the gasserian ganglion.

The patients often present with symptoms referable to the fifth nerve, but ocular palsies are also common. Our results show that in nine of 12 patients recovery...
of fifth nerve dysfunction was incomplete after operation; however, improvement in ocular motor muscle palsies was the rule, presumably because the tumors in Meckel's cave compressed these nerves rather than becoming intrinsically involved with the nerve fibers.

It is of interest that only three of our 12 patients presented with facial pain. In these three the tumor had extended into the posterior fossa overlying the root entry zone of the fifth nerve. Tumors confined (radiologically and at surgery) to Meckel's cave presented either with no symptoms referable to the fifth nerve, or with fifth nerve dysfunction but no neuralgic symptoms. While this is an interesting finding and supports the current theories of trigeminal neuralgia, there are many documented reports of lesions confined to the ganglion and Meckel's cave producing either trigeminal neuralgia or atypical facial pain. Recently, trigeminal neuralgia has been reported in three patients with contralateral mass lesions. The mechanism was presumably due to compression and distortion of the brain stem or the trigeminal nerve.

The presence of exophthalmos localized the anterior extent of the lipoma and the arachnoid cyst. In both, the cause was compression of the ipsilateral cavernous sinus with subsequent venous engorgement of the ophthalmic veins. The arachnoid cyst was treated by opening the cyst cavity and creating a communication with the basal cistern. The lipoma was only subtotally removed, but the exophthalmos quickly resolved presumably due to the dural decompression over Meckel's cave relieving the cavernous sinus compression.

Computerized tomography and MRI permit the detection of small lesions in this area. Magnetic resonance imaging was especially useful in low-density tumors, such as a lipoma, epidermoid cyst, and chordoma. In Cases 9 and 10, for example, the margins of the tumor were indistinct on CT, and only the presence of bone erosion suggested a mass lesion.

All the tumors in our series were resected via the subtemporal intradural approach. Intraoperative spinal drainage, hyperventilation, and intravenous mannitol reduced brain bulk, and temporal lobe retraction was minimal. In some cases the tumor may not be readily seen as it may not extend medially as far as the tentorium. A bulge was usually seen under the medial aspect of the dura and was best appreciated with the naked eye. The dural opening must be made parallel to the tentorial edge in order to avoid cutting across fibers of the trigeminal nerve that lie directly beneath.

The majority of tumors in this location are benign and amenable to total removal. Two exceptions are the epidermoid tumors and lipomas. Flecks of capsule from the epidermoid tumors are often adherent to nerve fibers and brain stem, and attempts to remove the entire capsule would significantly increase the neurological deficit. The recurrence rate of these tumors is very low as the remaining tumor cells do not multiply.

Melanotic schwannomas and lipomas are very rare in this location but they have been reported in the CPA. Intracranial lipomas are usually incidental findings. The major exceptions appear to be paracallosal cistern lipomas, which are often associated with convulsive disorders, and those in the CPA, where 11 of 15 reported cases were symptomatic. The one lipoma in our series extended from Meckel's cave into the CPA, without affecting the seventh or eighth cranial nerves. The presentation of exophthalmos, as in Cases 11 and 12, has not been previously reported. Since these lesions consist of non-dividing tissue, debulking of the mass without total removal should give the patient...
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long-term relief without sacrificing any cranial nerve function.

Both malignant and benign melanotic schwannomas of the trigeminal nerve have been reported.\(^{10,15}\) Neuro-radiologically, they appear to have similar characteristics to schwannomas in that area, but at surgery the black color from the melanin-containing cells can be readily identified. Malignant melanotic schwannomas are often associated with erosion of bone, either at the petrous ridge or at one of the foramina from which the trigeminal nerve exits. This is one example of the rare primary malignant tumors found in the area, as most malignant tumors in Meckel’s cave are secondary to metastasis from the nearby nasopharynx. Although no definitive answer to the best course of management of melanotic schwannomas is available, our patient (Case 8) received 5000 rads of radiation therapy 2 years postoperatively to treat a recurrence of the tumor. As demonstrated on CT scanning, he is doing well 9 years after surgical treatment of the original tumor.

References


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