Intraosseous Meningioma of the Posterior Fossa
—Case Report—

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Abstract

A 62-year-old male presented with a rare intraosseous meningioma with intradural extension manifesting as frequent vomiting and floating sensation that had persisted for 3 months. Neuroimaging detected a mass lesion that was mainly located extradurally in the right posterior fossa with a daughter lesion inside the dura. He underwent surgical excision of the mass lesion. Craniectomy exposed the main lesion of the tumor just beneath the thinned outer table of the skull, and in the extradural space, with the daughter lesion penetrating the dura. Both portions of the tumor were resected. There was no attachment to the adjacent dura mater. Histological examination showed meningotheliomatous meningioma containing scattered bony tissue. This intraosseous meningioma probably originated from the occipital bone with a small intradural extension caused by mechanical compression.

Key words: intraosseous meningioma, posterior fossa, intradural extension

Introduction

Meningiomas usually originate from clusters of arachnoid cap cells located in the external layer of the arachnoid membrane. However, these tumors may also arise from other areas including the skull. Meningiomas that arise directly from the skull have been termed intraosseous, calvarial, diploic, or epidural meningiomas, but only 48 cases have been described to date. Here, we describe another case of intraosseous meningioma of the posterior fossa with unique clinical and neurological features.

Case Report

A 62-year-old male was admitted to our hospital with frequent vomiting and floating sensation that had persisted for 3 months with gradual progression. Neurological examination on admission revealed bilateral saccadic eye movement, left-sided fixation nystagmus, and right-sided dysmetria. Skull radiography showed a radiolucent lesion in the occipital bone. Computed tomography (CT) showed a dumbbell-shaped mass lesion, consisting of a $5 \times 4$ cm main lesion and a $1.5 \times 2$ cm daughter lesion, in the posterior fossa with homogeneous enhancement by contrast medium. Bone window CT demonstrated osteolysis in the occipital bone associated with a spiculated, calcified shadow within the mass lesion (Fig. 1). Magnetic resonance (MR) imaging showed that the dura mater extended between the main lesion and the daughter lesion, indicating that the main mass was located in the epidural space and the daughter lesion in the intradural space (Fig. 2). Cerebral angiography showed a tumor stain which indicated that the mass was supplied mainly by the right occipital artery, and partially by the right posterior meningeal artery (Fig. 3).

The tumor was resected via the right suboccipital approach under general anesthesia. Craniectomy exposed the main lesion of the tumor located just beneath the thinned outer table of the skull, and in the extradural space (Fig. 4). Removal of the large epidural mass revealed the apparently intact dura mater, but with a small round defect in the center.
Fig. 1 A: Computed tomography (CT) scan with contrast medium showing a dumbbell-shaped mass lesion, consisting of a $5 \times 4 \text{ cm}$ main lesion and a $1.5 \times 2 \text{ cm}$ daughter lesion, in the posterior fossa. B: Bone window CT scan demonstrating osteolysis in the occipital bone associated with a spiculated, calcified shadow (arrow) within this mass lesion.

Fig. 2 T_{1}-weighted magnetic resonance images, axial with contrast medium (A), and sagittal without (B) and with contrast medium (C), disclosing the dura mater extending between the main and daughter lesions.

Fig. 3 A: Right common carotid angiogram showing a tumor stain indicating the mass is supplied mainly by the right occipital artery. B: Right vertebral angiogram revealing tumor staining derived partially from the right posterior meningeal artery.

The daughter mass was observed extending into the intradural space through this dural defect. The smaller mass was completely resected without complications. There was no tumor attachment to the adjacent dura mater or sinus.

The postoperative course was uneventful, and the patient was discharged 10 days after surgery. MR imaging detected no recurrence during follow up for 4 months.

Histological examination of the tumor specimen revealed meningotheliomatous meningioma containing scattered bony tissues (Fig. 5). The cellularity was apparently high, but the MIB-1 staining index was 2.4%, suggesting low proliferative potential. (In our institution, the mean MIB-1 staining index of meningioma is 2.0% [8 cases], anaplastic meningioma is 28.7% [8 cases], low grade astrocytoma is 3.1% [8 cases], anaplastic astrocytoma is 13.6% [8 cases], and glioblastoma multiforme is 19.7% [8 cases]. We regard tumors with MIB-1 staining index of more than 10% as malignant tumors.)

Finally, we concluded that the tumor had originated from the occipital bone and had formed a small intradural extension.
Discussion

Ectopic meningiomas arise from arachnoidal cell rests that persist in non-dural locations. Ectopic meningiomas constitute less than 1% of all meningiomas, but have occurred in many locations in the head and neck including the subcutaneous tissues of the skin, orbit, paranasal sinuses, intraosseous, salivary glands, and along the perineural sheaths of cranial nerves. Meningiomas occurring outside the cranium can be classified into four groups: Direct extension from a primary intracranial meningioma through the foramina of the base of the skull; extracranial growth from arachnoid cells within the sheaths of cranial nerves; extracranial growth from embryonic arachnoid rests with no apparent connection to the foramina of the skull base or cranial nerves; and distant metastases from intracranial meningiomas. Meningiomas originating in the subcutaneous, intraosseous, or paranasal sinus belong to the third group, as in the present case.

Meningiomas originating from the skull are designated as intraosseous, calvarial, diploic, or epidural meningiomas. Review of the literature reveals 48 cases of so-called intraosseous meningiomas. Patients were aged from 7 months to 79 years (mean 45.4 years). The male to female ratio was 23:25. The most common location was the parietal region (15 cases), followed by the frontal region (14 cases). Interestingly, no tumor has occurred in the occipital region.

The etiology of intraosseous meningiomas has not been clarified, but some hypotheses have been proposed. Part of the dura carrying rests of arachnoid cap cells might be trapped in the suture during delivery or molding of the skull and subsequently develop into a meningioma. Arachnoid cap cells caught in the fracture line at head trauma may be responsible for intraosseous meningiomas. Mesenchymal precursors have multipotential ability to differentiate into various tissues such as fibrous, mucoid, meningeal, adipose, cartilaginous, synovial, osseous, hematopoietic, vascular, and reticuloendothelial tissue, and so may develop into intraosseous meningiomas. The latter hypothesis is supported by the occasional observation that these tissue types develop via metaplasia within meningiomas. Only 17 reported cases (35.5%) were associated with trauma, whereas 31 cases (64.5%), including ours, had no history of trauma. Furthermore, 34 cases (70.8%) had an association with cranial suture (16 of coronal suture and 6 of sagittal suture), but 14 (29.2%) did not. Histological examination showed 30 cases (62.5%) were meningothelioma-
tous, four (8.3%) were fibroblastic, 12 (25.0%) were transitional, one (2.1%) was psammomatous, and one (2.1%) was malignant meningioma.

The tumor in our case had a small intradural portion, but surprisingly there was no attachment or invasion to the adjacent dura mater. We postulate that mechanical compression of the tumor had resulted in penetration of the underlying dura. Primary intraosseous meningiomas do not involve the underlying dura, and involvement of the underlying dura indicates secondary invasion of the bone.6)

References

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Neurol Med Chir (Tokyo) 41, March, 2001

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