Surgical Removal of Pineal Region Meningioma

—Three Case Reports—

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Abstract

Three patients with large or huge meningiomas of the pineal region presented with headache, vomiting, gait and visual disturbance, apraxia, agnosia, and transient amnesic aphasia. Computed tomographic scans revealed round, high-density areas of $8 \times 7 \times 7$ cm, $5 \times 5 \times 4$ cm, and $3 \times 3 \times 3$ cm in the pineal region. Angiography revealed that the bilateral internal cerebral veins and the great vein of Galen were stretched and significantly displaced upward in one patient, and downwards in the other two. The meningiomas appeared to originate from the verum interpositum and falcaten-torial junction, respectively. The tumors were removed subtotally or totally *via* an occipital interhemispheric transtentorial approach and/or infratentorial supracerebellar approach. The postoperative courses were uneventful, and no neurological deficit was detected postoperatively. Pineal region tumors with a maximum diameter of 5 cm or larger should be operated on *via* a unilateral or bilateral occipital interhemispheric transtentorial approach, regardless of the angiographic findings, because this permits a wide operative field and can be followed, if necessary, by an infratentorial supracerebellar approach. Selection of the operative approach for a relatively small pineal region tumor should depend on the angiographic findings: downward displacement of the bilateral internal cerebral veins and the great vein of Galen indicates an occipital interhemispheric transtentorial approach, whereas upward displacement indicates an infratentorial supracerebellar approach.

Key words: meningioma, pineal region, transtentorial approach, infratentorial approach

Introduction

Meningiomas of the pineal region are relatively rare, and difficult and dangerous to treat surgically because of the distance from the brain surface and the surrounding deep cerebral veins. Very few huge pineal region meningiomas have been reported.^{3,8,9)}

We describe three patients with large or huge pineal region meningiomas, which were successfully removed surgically, and discuss the operative approaches involved.

Case Reports

Case 1: A 34-year-old female was admitted with a history of headache and vomiting persisting for 1 year, and gait and visual disturbances for 1 month on June 29, 1990. Computed tomography (CT) revealed hydrocephalus and a huge ($8 \times 7 \times 7$ cm),

round, high-density area in the pineal region, with marked and homogeneous postcontrast enhancement (Fig. 1 *left*). Bilateral papilledema was observed, but no other neurological abnormalities were noted. An emergency ventriculoperitoneal shunt was implaced on the day of admission.

Sagittal T₁-weighted magnetic resonance (MR) imaging showed a homogeneous iso-intensity area in the pineal region (Fig. 2 *left*), which was strongly enhanced following the administration of gadolinium-diethylenetriaminepenta-acetic acid (Gd-DTPA). Left carotid angiography demonstrated a huge homogeneous tumor stain in the capillary and venous phases. The main feeding arteries of the tumor were the bilateral posterior choroidal arteries and the right middle meningeal artery. The bilateral internal cerebral veins and the great vein of Galen were stretched and displaced significantly upward (Fig. 3 *left*). The diagnosis was a pineal region me-

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Fig. 1 Case 1. *left*: Preoperative postcontrast axial CT scans, showing hydrocephalus and a mass lesion of 8 cm maximum diameter in the pineal region, which was homogeneously and strongly enhanced. *right*: Postoperative postcontrast axial CT scans.

ningioma.

A four-staged operation was performed: a right occipital interhemispheric transtentorial approach for the first two stages, a bilateral occipital interhemispheric transtentorial approach for the third stage, and an infratentorial supracerebellar approach for the last stage. The hemorrhagic and fibrous tumor, which penetrated the right cerebellar tentorium, was totally removed, except for the portion attached to the great vein of Galen and the straight sinus (Fig. 1 *right*, Fig. 2 *right*, and Fig. 3 *right*). Histological examination demonstrated that this tumor was a fibroblastic type of meningioma. Her postoperative course was uneventful, and no neurological deficit was detected postoperatively.

Case 2: A 51-year-old male presented with gait disturbance, apraxia, and visual agnosia beginning 1 week previously. He had a history of occipitalgia persisting for several years. He was admitted to our hospital on September 24, 1983. CT revealed a huge (5 × 5 × 4 cm), round, high-density area in the falcotentorial region (Fig. 4 *left*). Right carotid

Fig. 2 Case 1. *left*: Preoperative sagittal T₁-weighted MR image, showing a homogeneous iso-intensity area in the pineal region. *right*: Postoperative T₁-weighted MR image with Gd-DTPA.

Fig. 3 Case 1. *left*: Preoperative left carotid angiogram in the venous phase, showing a huge homogeneous tumor stain and stretching and upward displacement of the bilateral internal cerebral veins and the great vein of Galen. *right*: Postoperative left carotid angiogram.

angiography demonstrated that the bilateral internal cerebral veins and the great vein of Galen were stretched and displaced significantly downward (Fig. 5 *left*). The diagnosis was a pineal region meningioma.

A two-staged operation was performed: a right occipital interhemispheric transtentorial approach for the initial stage, and a bilateral occipital interhemispheric transtentorial approach for the second stage. The fibrous tumor, which was located below the falcotentorial junction and falx, was totally removed except for the portion attached to the great vein of Galen at the falcotentorial junction (Fig. 4 *right*). Postoperative cerebral angiography demonstrated reduced stretching and downward displacement of both the bilateral cerebral veins and the great vein of Galen (Fig. 5 *right*). Histological examination demonstrated a fibroblastic type of me-

Fig. 4 Case 2. *left*: Preoperative postcontrast axial CT scans, showing hydrocephalus and a mass lesion of 5 cm diameter in the falcotentorial region, which was strongly enhanced. *right*: Postoperative postcontrast axial CT scans.

Fig. 5 Case 2. *left*: Preoperative right carotid angiogram in the venous phase, showing that the bilateral internal cerebral veins and the great vein of Galen are stretched and displaced substantially downward. *right*: Postoperative right carotid angiogram.

ningioma. His postoperative course was uneventful, and no neurological deficit was detected postoperatively.

Case 3: A 60-year-old female was admitted with transient amnesic aphasia. CT revealed a large ($3 \times$

3×3 cm), round, high-density area in the pineal region. Cerebral angiography demonstrated that the deep cerebral veins were stretched and displaced significantly downward.

Via a right occipital interhemispheric approach, the fibrous tumor was totally removed. Histological examination demonstrated a fibroblastic type of meningioma. Her postoperative course was uneventful, and no neurological deficit was detected postoperatively.

Discussion

Horsley was the first surgeon to remove a tumor in the pineal region, *via* an infratentorial approach. Krause and Oppenheim^{2,5)} and Zapletal¹⁰⁾ also removed tumors in the pineal region *via* an infratentorial supracerebellar approach. Since then, several different operative approaches have been reported, but the results have not been very good. Stein⁷⁾ reported microsurgery on pineal region tumors *via* an infratentorial supracerebellar approach, and Jamieson¹⁾ has used an occipital interhemispheric transtentorial approach. Sano⁶⁾ has used occipital transtentorial, infratentorial, and anterior trans-callosal trans-velum interpositum approaches.

The occipital interhemispheric transtentorial approach can easily visualize the internal cerebral veins and the back and side of the midbrain. In addition, if the patient is placed in a prone or lateral position, there is no risk of an air embolism. However, if a unilateral approach is used, the contralateral side of the falx cannot be visualized, making a tumor extending upwards to the contralateral side difficult to remove. When the infratentorial supracerebellar approach is used, the bilateral basal veins, the great vein of Galen, the precentral cerebellar veins, and the vermian veins can be seen. Therefore, this approach can be used to remove a pineal region tumor and also a third ventricular tumor, which are surrounded by these deep cerebral veins. However, a tumor extending downward to the third ventricle cannot be seen.

Angiography can indicate the origin of the tumor. Tumors originating from the verum interpositum and falcotentorial junction cause upward and downward displacement of the internal cerebral veins and the great vein of Galen, respectively.⁴⁾ Our Case 1 represents the former, and Cases 2 and 3 the latter. Based upon our experience, pineal region tumors with a maximum diameter of 5 cm or larger should be operated on *via* a unilateral or bilateral occipital interhemispheric transtentorial approach,

regardless of the angiographic findings, because this permits a wide operative field, and can be followed, if necessary, by an infratentorial supracerebellar approach. If the pineal region tumor is relatively small, with a maximum diameter of 3 cm or less, the selection of the operative approach should depend on the angiographic findings: downward displacement of the bilateral internal cerebral veins and the great vein of Galen indicates an occipital interhemispheric transtentorial approach, whereas upward displacement suggests that an infratentorial supracerebellar approach may be more advantageous.

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