Focused Approaches for Petroclival Meningiomas

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Petroclival meningioma (PCM) comprises 1 percent of all intracranial meningiomas. Due to their proximity to the brainstem, cranial nerves, and vasculature within the posterior fossa, they are amongst the most formidable tumors to resect. These tumors demonstrate insidious growth with relentless symptomatic progression that, if left untreated, often leads to fatal outcomes.

Conventional transpetrosal approaches mandate excess bone and soft tissue dissection. Despite the use of deleterious cerebellar and temporal lobe retraction, this approach often does not provide adequate access to the tumor.

At the Skull Base Center at Baylor University Medical Center at Dallas, focused anterior and posterior transpetrosal approaches may be utilized to approach PCMs. These innovative approaches may be customized and allow for adequate extradural access to posterior and middle fossa tumors with minimal manipulation of the brain tissue.

**CASE STUDY**

A 59-year-old physician presented with right-side hearing loss, progressive gait difficulty, left-side weakness and general cognitive decline. MRI showed a 6 x 6 centimeter right PCM involving the posterior and middle fossa with significant brain stem compression and midline shift (Figure 1). Because the massive tumor extended from the optic canal to the jugular foramen, a two-stage skull base resection was planned.

**STAGE 1:** A focused posterior and anterior transpetrosal-translabyrinthine-transentorlial approach allowed access from the interpeduncular fossa to the jugular foramen. The tumor was dissected away from the vertebrobasilar system and cranial nerves III to X. Post-operatively, the patient displayed a right VI deficit. MRI demonstrated resection of the posterior fossa component with expected residual in the right middle cranial fossa (Figure 2). Pathology revealed WHO Grade I meningioma.

**STAGE 2:** A right focused orbito-zygomatic approach allowed extradural access to the optic canal, anterior clinoid and cavernous sinus. The tumor was dissected away from the optic apparatus, the carotid and cerebral arteries, cranial nerve III, and the pituitary. Post-operatively, the patient had a partial III-nerve palsy and underwent six weeks of inpatient rehabilitation. MRI confirmed resection of the entire tumor in the subarachnoid space with a small residual in Meckel's cave (Figure 3).

One year later, the patient underwent CyberKnife® stereotaxic radiosurgery. A total dose of 25 Gy was delivered in five fractions to the 58 percent isodose line of the residual tumor in Meckel’s cave.

At 30 months, the patient has recovered his deficits and has normal gait, left-side strength and cognition. The post-operative

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**Figure 1**

Axial T1-weighted MRI with contrast. A large posterior and middle fossa, extra-axial, enhancing mass. Note the brainstem compression and midline shift. There is extensive involvement of the cavernous sinus, Meckel's cave and petrous apex.

**Figure 2**

Axial T1-weighted MRI with contrast. Tumor resected from the posterior fossa. Midline shift resolved and brainstem is not compressed. Residual enhancing tumor occupies the cavernous sinus, Meckel's cave, sella and middle fossa.

Continued
VI palsy has fully recovered and the III-nerve palsy is mostly resolved. The patient is fully independent and proficient in his high-functioning occupation.

In summary, because of their proximity and involvement with critical posterior and middle fossa structures, PCMs can be formidable lesions. This was a case of a massive PCM tumor that was successfully treated using a staged approach with minimal brain manipulation. A multi-disciplinary skull base team, modern operative and radiation facilities, and advanced, innovative surgical techniques are critical to consistent and effective care of these complex tumors.

Axial T1-weighted MRI with contrast. All tumor in the cavernous sinus, sella and middle fossa has been resected. Residual only in Meckel's cave that underwent stereotactic radiation and is stable.

VI palsy has fully recovered and the III-nerve palsy is mostly resolved. The patient is fully independent and proficient in his high-functioning occupation.

In summary, because of their proximity and involvement with critical posterior and middle fossa structures, PCMs can be formidable lesions. This was a case of a massive PCM tumor that was successfully treated using a staged approach with minimal brain manipulation. A multi-disciplinary skull base team, modern operative and radiation facilities, and advanced, innovative surgical techniques are critical to consistent and effective care of these complex tumors.

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