

## Petroclival meningioma

The small petrosal approach was found to be useful and safe as an alternative technique for selective removal of the lesion in the middle portion of the mediobasal temporal region <sup>1)</sup>.

The [combined petrosal approach](#) is a suitable technique for the resection of medium-to-large petroclival meningiomas (PCMs), and suited for patients with serviceable hearing on the side of the lesion.

This approach enhances petroclival exposure and the degree of tumor resection, especially in the area of the [petroclival junction](#), middle clivus, apical petrous bone, posterior cavernous sinus, and Meckel's cave. The combined petrosal approach also allows better visualization of the contralateral side and the ventral brainstem, which facilitates safe dissection of the tumor from the brainstem, the basilar artery, and the perforators. If a patient has an early draining bridging vein to the tentorial sinus (before it reaches the transverse-sigmoid junction) or a prominent sigmoid sinus and jugular bulb, the combined petrosal approach provides significant working space <sup>2)</sup>.

Multiple technical modifications have been reported to increase the surgical corridor, including the method of dural and tentorial opening.

The petrosal approach is based on sectioning the superior petrosal sinus (SPS) and the tentorium. However, the venous anatomy in certain situations forbids this maneuver.

Sparing of the SPS or cutting of the tentorium is an effective means for cases in which the venous anatomy mandates preservation of these structures <sup>3)</sup>.

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Anterior [transpetrosal approach](#) (ATPA) is a less aggressive [skull base approach](#) and could provide sufficient exposure for the [petroclival region](#) and has additional advantages for a selected group of [petroclival meningiomas](#) (PCMs) <sup>4)</sup>.

It is the most appropriate approach for petroclival meningiomas, which are typically located from the [dorsum sellae](#) to the upper border of the [internal acoustic meatus](#) (IAM). Although neurosurgeons can resect over this area if the tumor is detached from the dura, tumors within the indication area for petroclival meningiomas is insufficient for the selection of the ATP approach because it can be difficult to evaluate whether the tumor is attached or only touching the dura <sup>5)</sup>.

Besides, there are also several disadvantages such as troublesome extradural bleeding and the risk of damaging [facial nerve](#) and [internal carotid artery](#) <sup>6)</sup>.

The anterior transpetrosal approach (ATPA) stands out as a method for granting entry into the upper and middle clival areas.

Identification and protection of the [cochlea](#) during [anterior petrosectomy](#) is key to prevent hearing loss. Currently, there is no optimal method to infer the position of the cochlea in relation to the Kawase quadrangle, therefore damage to the cochlea during anterior petrosectomy remains a substantial risk.

An anterior [transpetrosal approach](#) (ATPA) is suitable for treating upper petroclival lesions. However, the limit of the ATPA is reached when the tumor extends posterolaterally over the internal auditory canal (IAC) along the petrous edge. In such cases, ligation of the posterior part of the [superior](#)

**petrosal sinus** (SPS) is necessary. To overcome this limitation, Shibao et al. combined the ATPA with a partial posterior **petrosectomy** in 8 patients who had petroclival meningiomas extending posterolaterally over the IAC <sup>7)</sup>

They are extensions of the basic middle fossa approach.

The middle fossa approaches spare the lateral petrous bone and involve resection of the medial **petrous bone** to various degrees. All of the middle fossa approaches are designed to preserve hearing. Extensions of the middle fossa approaches involve resection of bone within the **Kawase triangle** and division of the **tentorium** to provide exposure of the **posterior fossa**.

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Borghei-Razavi et al. reviewed pre- and postoperative Multi-Slice CT scan (1mm thickness) of patients with **petroclival meningioma** between Jan 2009 and Sep 2013 in which anterior petrosectomy was performed to access the posterior fossa part of the tumor. The distances between drilling start and finish edge to the vital anatomical skull base structures such as internal auditory canal (IAC) and superior semicircular canal and petrous apex (petrous part of the carotid artery) were measured and analyzed.

Drilling entrance length is directly related with tumor size. The distances between anatomical structures and drilling points decrease with increasing tumor size, but it always remains a safe margin between drilling points and IAC, internal carotid artery (ICA), and semicircular canals in axial and coronal views.

The **Kawase triangle** is shown to be a safe anatomical landmark for anterior petrosectomy. The described landmarks avoid damage to the vital anatomical structures during access to the posterior fossa through middle fossa, despite temporal bone anatomical variations and different tumor sizes <sup>8)</sup>.

1)

Türe U, Pamir MN. Small petrosal approach to the middle portion of the mediobasal temporal region: technical case report. *Surg Neurol*. 2004 Jan;61(1):60-7; discussion 67. PubMed PMID: 14706382.

2)

Cho CW, Al-Mefty O. Combined petrosal approach to petroclival meningiomas. *Neurosurgery*. 2002 Sep;51(3):708-16; discussion 716-8. PubMed PMID: 12188949.

3)

Hafez A, Nader R, Al-Mefty O. Preservation of the superior petrosal sinus during the petrosal approach. *J Neurosurg*. 2011 May;114(5):1294-8. doi: 10.3171/2010.6.JNS091461. Epub 2010 Jul 9. PubMed PMID: 20617877.

4)

Ichimura S, Kawase T, Onozuka S, Yoshida K, Ohira T. Four subtypes of petroclival meningiomas: differences in symptoms and operative findings using the anterior transpetrosal approach. *Acta Neurochir (Wien)* 2008;150:637-645. doi: 10.1007/s00701-008-1586-x.

5)

Adachi K, Hasegawa M, Tateyama S, Kawazoe Y, Hirose Y. Surgical strategy for and anatomical locations of petroapex and petroclival meningiomas based on evaluation of the feeding artery. *World Neurosurg*. 2018 May 16. pii: S1878-8750(18)31005-2. doi: 10.1016/j.wneu.2018.05.052. [Epub ahead of print] PubMed PMID: 29777891.

6)

Xiao X, Zhang L, Wu Z, Zhang J, Jia G, Tang J, Meng G. Surgical resection of large and giant petroclival meningiomas via a modified anterior transpetrosal approach. *Neurosurg Rev*. 2013 Oct;36(4):587-93; discussion 593-4. doi: 10.1007/s10143-013-0484-8. Epub 2013 Jun 18. PubMed PMID: 23775013;

PubMed Central PMCID: PMC3771372.

7)

Shibao S, Borghei-Razavi H, Orii M, Yoshida K. Anterior Transpetrosal Approach Combined with Partial Posterior Petrosectomy for Petroclival Meningiomas with Posterior Extension. *World Neurosurg*. 2015 Apr 1. pii: S1878-8750(15)00350-2. doi: 10.1016/j.wneu.2015.03.055. [Epub ahead of print] PubMed PMID: 25841755.

8)

Borghei-Razavi H, Tomio R, Fereshtehnejad SM, Shibao S, Schick U, Toda M, Kawase T, Yoshida K. Anterior petrosal approach: The safety of Kawase triangle as an anatomical landmark for anterior petrosectomy in petroclival meningiomas. *Clin Neurol Neurosurg*. 2015 Oct 28;139:282-287. doi: 10.1016/j.clineuro.2015.10.032. [Epub ahead of print] PubMed PMID: 26552034.

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