Retrosigmoid transmeatal approach for vestibular schwannoma

- Intracanalicular vestibular schwannomas: facial and hearing outcomes according to the location of the tumor in relation to the nerves of the internal auditory canal
- Endoscopic resection through a retrosigmoid transmeatal approach of a large-sized vestibular schwannoma: operative video and technical nuances
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- Microsurgery for Vestibular Schwannoma via Retrosigmoid Transmeatal Approach with Intraoperative Monitoring Techniques
- Magnetic Resonance Imaging Surveillance for Vestibular Schwannoma After Microsurgical Resection Using a Retrosigmoid Transmeatal Approach
- Hearing preservation in vestibular schwannoma surgery via retrosigmoid transmeatal approach

see also Retrosigmoid transmeatal approach for intracanalicular vestibular schwannoma.

The retrosigmoid transmeatal approach is one of the surgical techniques used for the removal of vestibular schwannomas It is considered when surgical intervention is needed to remove the tumor while preserving hearing and minimizing other neurological complications.

Here's a breakdown of the key aspects of the retrosigmoid transmeatal approach:

Approach Type:

Retrosigmoid: This indicates that the surgical approach is through the posterior cranial fossa, near the back of the head.

Transmeatal: The term “transmeatal” signifies that the approach involves going through the ear canal.

Objective:

The primary goal of the retrosigmoid transmeatal approach is to access and remove vestibular schwannomas located within the internal auditory canal (IAC) while preserving hearing and minimizing damage to surrounding structures.

Access Point:

The surgical access point is typically made behind the ear, exposing the cerebellopontine angle, which is the region where the cerebellum and the pons meet.

Nerve Preservation:

This approach aims to preserve the facial nerve (responsible for facial movement) and the cochlear

nerve (responsible for hearing). It allows for careful dissection and removal of the tumor while minimizing damage to adjacent nerves.

Microsurgical Technique:

Microsurgical techniques are commonly used during the retrosigmoid transmeatal approach. Surgeons use a microscope to visualize and delicately manipulate structures, ensuring precision during tumor removal.

Postoperative Recovery:

After surgery, patients typically undergo a period of recovery, and the length of hospital stay varies. Rehabilitation may be necessary, and postoperative follow-up assessments are crucial to monitor for any potential complications. It's essential to note that the choice of surgical approach depends on various factors, including the size and location of the tumor, the patient's overall health, and the preservation of neurological function goals. The retrosigmoid transmeatal approach is just one of several surgical techniques used for vestibular schwannoma removal, and the selection of the most appropriate approach is determined on a case-by-case basis by the treating neurosurgeon.

Equipment

a) Microscope

b) Ultrasonic aspirator

c) Neuronavigation (if used) (may be helpful for placing skin incision and craniotomy more than for tumor localization).

Neuromonitoring

Facial EMG (does not require EEG tech), BAERS, near field monitoring (CNAP:compound nerve action potential)

Position

Lateral decubitus position with tumor side up.

Head in pins rotated (might need shoulder roll).

Zygomatic arch horizontal. 30° elevation of the head is paramount.

Percutaneous lumbar drain (optional)

Skin incision

Incision is shaped like the pinna of the ear, 3 finger breaths behind the external auditory canal.

see Retrosigmoid approach.

Craniotomy

The craniotomy has to be lateral enough to expose part of the sigmoid and part of the transverse sinuses and to allow a straight line of sight to the lateral end of the IAC.

To prevent CSF leak, seal all bone edges with bone wax.

Dural opening

The dura is opened under the microscope in semilunar fashion parallel to the course of the sigmoid sinus.

Exposure is enhanced by opening the cerebello-pontine angle cistern and the cisterna magna under the microscope and draining CSF (20–40 ml of CSF can also be drained via a lumbar subarachnoid catheter).

The petrosal vein is often sacrificed at the beginning of the procedure to allow the cerebellum to relax and fall back and to avoid tearing o the transverse sinus. Be careful not to coagulate the SCA that often runs with the petrosal vein.

Using the facial nerve stimulator, the posterior aspect of the tumor is inspected to make sure the facial nerve has not been pushed posteriorly.

The thin layer of arachnoid that covers most tumors is identified. Vessels within the arachnoid may contribute to cochlear function and may be preserved by keeping them with the arachnoid.

The plane between tumor and cerebellum may be followed to the brainstem, and occasionally to the VII nerve (this plane is harder to follow once bleeding from tumor debulking occurs).

The posterolateral tumor capsule is opened, and internal decompression is performed. The tumor is collapsed inward and the capsule is kept intact and is rolled laterally o of VII and is eventually removed. The most di cult area to separate VII from tumor is just proximal to the entrance to the porus acusticus. Ageneral recommendation is to accept a subtotal or near total resection to preserve anatomic continuity of the facial nerve in cases where it is identified by stimulation but because it is so flattened it cannot be seen as a separate structure on the surface of the tumor.

After the extracanalicular portion of tumor is removed, the dura over the IACis incised, and the IACis drilled open and tumor is removed from this portion.To preserve hearing,the bony labyrinth must not be violated. The posterior semicircular canal (SCC) is the most vulnerable structure.

The vestibule of the SCCs is also at risk but is less likely to be entered. The maximal amount of temporal bone drilling that can be accomplished without entering the posterior SCC can be

determined from the pre-op CT.

The operculum of the temporal bone, is a small step-o palpable with a nerve hook posteriorly from the porus acusticus. It marks the location of the vestibular aqueduct and is a good landmark for the posterior extent of the drilling in the retrosigmoid exposure of the IAC. Measuring the distance from the IAC to the posterior semicircular canal on a pre-op CT and measuring the thickness of the bone overlying the posterior semicircular canal are recommended for safe exposure of the IAC, in particular for hearing preservation. However, opening the labyrinth cannot always be avoided; and any opening should be plugged with bone wax or muscle.

If the facial nerve is not intact and is not going to be grafted, then the IAC should be plugged, e.g. by bone wax covered with a small piece of ham mered muscle (hammering makes the muscle sticky by activating extrinsic clotting fac-tors) and Gelfoam®.

In some large tumors, the capsule may be adherent to the brainstem and so portions of tumor must be left; recurrence rate among these is 10-20%

Large tumors may also involve V superiorly (sometimes VII is pushed up against V), and inferiorly may involve IX, X, and XI. The lower cranial nerves can usually be spared by dissecting them off of the tumor capsule, and pro-tecting them with cottonoids.

Drilling

see Transmeatal drilling

The intrameatal part of the vestibular schwannoma is partially removed and the facial nerve identified. Thereafter, opening of the capsule and debulking of the tumor with an ultrasonic surgical aspirator in the cerebellopontine angle CPA. Once the tumor's mass is significantly reduced, a bimanual dissection of the cleavage plane between capsule and the surrounding arachnoid is performed. Starting from below, the capsule is elevated with a tumor grasping forceps and the arachnoid membrane is peeled off. Following the cleavage plane, the facial nerve is separated in a medial to lateral direction from the VS's capsule. Throughout the whole procedure the field is irrigated with warm Ringer's solution. Its important to seal the drilled posterior lip of the IAC as well as eventually opened mastoid air cells with a free muscle or fat patch [1)].

Bloodless microdissection

Sufficient coring-debulking

Capsular elevation to locate the facial and cochlear nerves both electrophysiologically and by visual observation

Sharp dissection of the facial and cochlear nerves

Avoidance of heat and mechanical injury to the nerves, the internal auditory artery, and the brain stem.

Besides these techniques, appropriate instruments are essential to preserve hearing. The function of

the facial and cochlear nerves should be the foremost concern. Meticulous techniques and the knowledge of microsurgical anatomy lead to hearing preservation with maximum tumor removal [2].

Endoscope

see Endoscope assisted retrosigmoid intradural suprameatal approach

Complications

see Vestibular schwannoma surgery complications.

Videos

Retrosigmoid transmeatal approach for vestibular schwannoma videos.

1)
Tatagiba M, Roser F, Schuhmann MU, Ebner FH. Vestibular schwannoma surgery via the retrosigmoid transmeatal approach. Acta Neurochir (Wien). 2013 Nov 30. [Epub ahead of print] PubMed PMID: 24292774.
2)
Wanibuchi M, Fukushima T, Friedman AH, Watanabe K, Akiyama Y, Mikami T, Iihoshi S, Murakami T, Sugino T, Mikuni N. Hearing preservation surgery for vestibular schwannomas via the retrosigmoid transmeatal approach: surgical tips. Neurosurg Rev. 2014 Jul;37(3):431-44; discussion 444. doi: 10.1007/s10143-014-0543-9. Epub 2014 Apr 22. PubMed PMID: 24752423.