20 Translabyrinthine Approach

**Definition**
Following the extended cortical mastoidectomy and exenteration of the posterior part of the labyrinth, exposure of the internal auditory canal, and cerebellopontine angle through the posterior cranial fossa.

**Indications**
The main indication of this technique is in acoustic neuroma surgery where the hearing is not of concern. However, it may also be carried out for different neurotologic procedures.

**Anatomical Orientation**

- **Left**
- **Anterior**
- **Medial**
- **Inferior**
- **Lateral**
- **Posterior**
- **Superior**
Translabyrinthine approach—an intermediate stage
Surgical Steps

A classical cortical mastoidectomy, including posterior tympanotomy has been carried out. The temporal bone is ready for the main steps of the translabyrinthine approach. The limits of the approach are indicated in the figure.

EAC: External auditory canal
MCF: Middle cranial fossa (dural plate)
MT: Mastoid tip
SS: Sigmoid sinus (dural plate)
ZR: Zygomatic root

First, the interlabyrinthine cells are drilled away using a medium-sized cutting burr. Note that the mastoid in this temporal bone is contracted, which means that the sigmoid sinus is located anteriorly and the dura of the middle cranial fossa is located inferiorly.

II: 3–4 mm cutting burr
MRIL: Posterior labyrinth (HSC, SSC, PSC)

Next, the retrolabyrinthine cells are exenterated using the same cutting burr. In such a contracted mastoid, turning the temporal bone toward the surgeon in the laboratory or tilting the operating table during surgery, would prevent having to work blindly.

RLC: Retrolabyrinthine cells
ILC: Interlabyrinthine cells

Definitions and Tips

- Lateral skull base surgery can be perceived as an extension of the classical tympanomastoid procedures. In this manner, the translabyrinthine approach is an extension of a cortical mastoidectomy and the transotic approach is an extension of a radical mastoidectomy.

- Labyrinth (otic capsule): Definition: The inner ear. Tips: The labyrinth is traditionally described as consisting of two parts; the anterior labyrinth and the posterior labyrinth. The anterior labyrinth, i.e., the anterior otic capsule, is formed by the cochlea. The posterior labyrinth, i.e., the posterior otic capsule, is formed by the vestibule and semicircular canals.
In the translabyrinthine approach, each anatomical structure should be used as a reference for locating the subsequent structure. Otology-neuro-otology and skull base surgery is based on moving from one landmark to the other. Ulug et al. showed that each anatomical structure of the cranium can be used as a landmark to define the next structure. (Ulug T, Sahinoglu K, Ozturk A, Ari Z. Surgical landmarks during mastoidal and petrosal operations. *Okajimas Folia Anat Jpn* 1998;75:163–166.)

The sinodural angle is delineated by first using a medium-sized cutting burr, then a diamond burr. The superior petrosal sinus, which runs along the sinodural angle inside the dura, should always be kept in mind and the drilling executed with care.

II: 3–4 mm cutting and diamond burrs
MIL: Sinodural angle

The microsurgical instrument is pointing to the exposed digastric ridge. The three semicircular canals are also displayed in this figure, where the next steps of the approach will be carried out.

HSC: Horizontal semicircular canal
MFN: Mastoid facial nerve
PSC: Posterior semicircular canal
SSC: Superior semicircular canal

Following complete exenteration of the interlabyrinthine, retrolabyrinthine, and retrofacial cells and delineation of the neighboring structures, the cavity has been enlarged from a classical cortical mastoidectomy to an extended cortical mastoidectomy. Note that the facial canal and all the semicircular canals have been skeletonized.

I: Incus
RFC: Retrofacial cells (removed)
SDA: Sinodural angle

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The next stage is exenteration of the semicircular canals. Each semicircular canal is drilled separately and carefully with a medium-sized cutting burr, to expose their lumens. The movement of the burr should be parallel to each semicircular canal. The instrument seen at the top right of the figure is the needle used for irrigation.

B: 3–4 mm cutting burr
MILL: The three semicircular canals

With progressive drilling, the lumen of each of the semicircular canals, including the common crus, is exposed completely. The opened horizontal, superior, and posterior semicircular canals are indicated in the figure.

CC: Common crus
HSC: Horizontal semicircular canal
PSC: Posterior semicircular canal
SSC: Superior semicircular canal

During this procedure, it is important not to drill carelessly inferior to the horizontal semicircular canal or anterior to the inferior part of the posterior semicircular canal, otherwise the facial nerve could be damaged. The figure shows a wide-angle view of this stage.

Definitions and Tips

- **Subarcuate artery**: Definition: The artery that runs through the hard bone in the arc of the superior semicircular canal. Tips: Knowing the location of the subarcuate artery may enhance accuracy during the drilling process, and it may also be used as an additional reference point in subsequent stages of the procedure.

- **The anterior wall of the horizontal semicircular canal should be preserved until the subsequent stages of the procedure; preservation of this wall means preservation of the facial canal in this area. As the procedure continues, the anterior wall of the horizontal semicircular canal is removed and the facial nerve is skeletonized.**
The technique in all the procedures requiring labyrinthectomy is based on exposure of the lumens of the semicircular canals and following these to the vestibule. Hasty drilling of the hard bone of the posterior labyrinth leads to the creation of “snake eyes,” resulting in difficulties when deciding in which direction to proceed with the drilling.

The internal auditory canal is located medial to the tympanic segment of the facial nerve and adjacent to the vestibule. The inexperienced surgeon incorrectly expects to find the internal auditory canal more posteriorly. It should be kept in mind that the medial wall of the vestibule also forms the lateral wall of the fundus of the internal auditory canal.

In the next stage, the internal auditory canal will be exposed. The remaining solid bone of the semicircular canals is drilled with medium-sized cutting burrs. Initially, the inferior limit of the exenteration should be the lumen of the horizontal semicircular canal, and the superior limit should be the ampulla of the superior semicircular canal.

The greater part of the semicircular canals has been extirpated, however, the ampulla and the last part of crus of the horizontal semicircular canal remain intact. The ampulla of the superior semicircular canal has been left untouched so that it can be used as a landmark during subsequent steps of the approach.

Following drilling of the ampulla of the horizontal semicircular canal, the vestibule is entered. Note the bulge of the facial canal. The drilling should continue with a diamond burr if more work is required inferiorly.

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Definitions and Tips

- **Spherical recess (recessus sphericus)**: Definition: The cavity in the anteroinferior part of the vestibule containing a little sac—the saccule (sacculus). Tips: Knowledge of the location of the spherical recess and saccule is essential for precise destruction of the labyrinth during a labyrinthectomy.

- **Elliptical recess (recessus ellipticus)**: Definition: The cavity in the posterosuperior part of the vestibule, containing a little sac—the utricle (utriculus). Tips: Knowledge of the location of the elliptical recess and the utricle is essential for precise destruction of the labyrinth during a labyrinthectomy.

Proceeding with the drilling, the vestibule is exposed completely. At this point, the elliptical and spherical recesses, located on the medial wall of the vestibule, can be observed. The superior semicircular canal ampulla is still preserved as a landmark.

- **B**: 2–3 mm cutting and diamond burs
- **MIL**: Superior semicircular canal ampulla
- **ASSC**: Ampulla of superior semicircular canal
- **EG**: External genu
- **MFN**: Mastoid facial nerve
- **V**: Vestibule

The continuation of drilling exposes the dural plates of the internal auditory canal and the posterior cranial fossa. The area where the internal auditory canal dura has just been exposed is displayed in the figure.

- **B**: 2–3 mm diamond burr
- **MIL**: Medial wall of vestibule
- **IAC**: Internal auditory canal (dura)
- **PCF**: Posterior cranial fossa (dural plate)

The internal auditory canal has been exposed completely. The curved micro dissector is pointing to the transverse crest, which is the critical landmark for the subsequent stages of the translabyrinthine approach.
The final stage is the opening of the dura and identification of the nerves running into the internal auditory canal. The superior and inferior vestibular nerves, which are located posteriorly in the canal, are separated by means of a curved micro dissector.

In addition to the superior and inferior vestibular nerves, the meatal segment of the facial nerve has also been exposed. The facial nerve lies anterior to the vertical crest.

**Definitions and Tips**

- **Transverse crest (falciform crest, crista transversa):** Definition: The horizontal spine that separates the fundus of the internal auditory canal into two parts. **Tips:** On the upper part of the fundus separated by the transverse crest are the facial nerve (anterosuperiorly) and the superior vestibular nerve (posterosuperiorly). On the lower part of the fundus are the cochlear nerve (anteroinferiorly) and the inferior vestibular nerve (posteroinferiorly). The transverse crest is an important reference point for all procedures involving the internal auditory canal.

**Abbreviations:**

- FN: Facial nerve
- IVN: Inferior vestibular nerve
- SVN: Superior vestibular nerve

Close-up view of the exposed internal auditory canal. The superior vestibular nerve, inferior vestibular nerve, and the facial nerve can all be seen in detail in this figure. Note the position of the incus and skeletonized facial canal laterally.
In this way the translabyrinthine approach has been completed. During the operation, the dura of the posterior cranial fossa is also exposed and incised to work at the cerebellopontine angle. The critical structures encountered in this approach are indicated in the figure.

**Definitions and Tips**

- The purpose of the translabyrinthine approach is exposure of the internal auditory canal, posterior cranial fossa, and cerebellopontine angle, without disturbing the integrity of the external auditory canal and tympanic cavity.
- During the live operation, the dural plates of the middle cranial fossa and posterior cranial fossa are removed, which affords not only better exposure, but also sufficient working space.