Labyrinthectomy

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Introduction:

Labyrinthectomy is an effective surgery for managing poorly compensated unilateral peripheral vestibular dysfunction in the presence of non-serviceable hearing ear. Relief from vertigo is achieved at the expense of residual hearing in the ear operated. This procedure is strictly reserved for patients with non-serviceable hearing.

Principle:

The principle is to open all the three semicircular canals and vestibule with preservation of landmarks till the end of the procedure. After exposure of all the ampullae of the semicircular canals and vestibules the five individual groups of sensory epithelia are excised under direct vision. This procedure eliminates abnormal vestibular input from the affected ear.

Indications:

1. In order to approach internal acoustic meatus in acoustic schwannoma surgery
2. Unilateral vestibular dysfunction with non-serviceable hearing
3. Severe and intractable Meniere's disease

Techniques:

Two techniques can be used for labyrinthectomy.

1. Trans canal labyrinthectomy
2. Trans labyrinthine labyrinthectomy

Trans canal labyrinthectomy:

This is an effective option for the management of poorly compensated unilateral peripheral vestibular dysfunction in the presence of ipsilateral profound sensorineural hearing loss. This technique was first introduced in 1950's by Schuknecht and Cawthrone.

Advantages of transcanal labyrinthectomy:

1. It is less invasive than transmastoid labyrinthectomy
2. It provides direct approach to vestibular end organ
3. The operating time is shorter when compared to that of transmastoid labyrinthectomy
4. It has lesser morbidity than transmastoid approach

The main disadvantage of this approach is that the exposure is highly unlimited. There is significant incidence of incomplete labyrinthectomy if the surgeon is not experienced. Reaching the ampulla of the posterior canal is difficult because it is performed with blind probing.

It should be stressed at this point that vestibular disorders should be given appropriate medical treatment and reconditioning exercised before embarking on labyrinthectomy.

In patients with bilateral vestibulocochlear disorders alternate techniques of labyrinthine destruction should be considered before surgery.

Indications for transmastoid labyrinthectomy:

1. Delayed onset vertigo syndrome
2. Unilateral severe Meniere's syndrome
3. Transcanal labyrinthectomy failures

Contraindications for labyrinthectomy:

1. If the affected ear is the only hearing ear
2. If the patient has serviceable hearing
3. Patients with poor surgical risk

Anesthesia:

This procedure is ideally performed under general anesthesia. Local anesthesia is not advisable because of violent reactions that could accompany vestibular ablation. Of course revision labyrinthectomy in an ear with minimal residual vestibular function can be performed under local anesthesia.

Position:

The patient is placed in supine position, with reverse Trendelenburg tilt and the neck extended. The head is turned away from the surgeon, with the ear to be operated facing up.

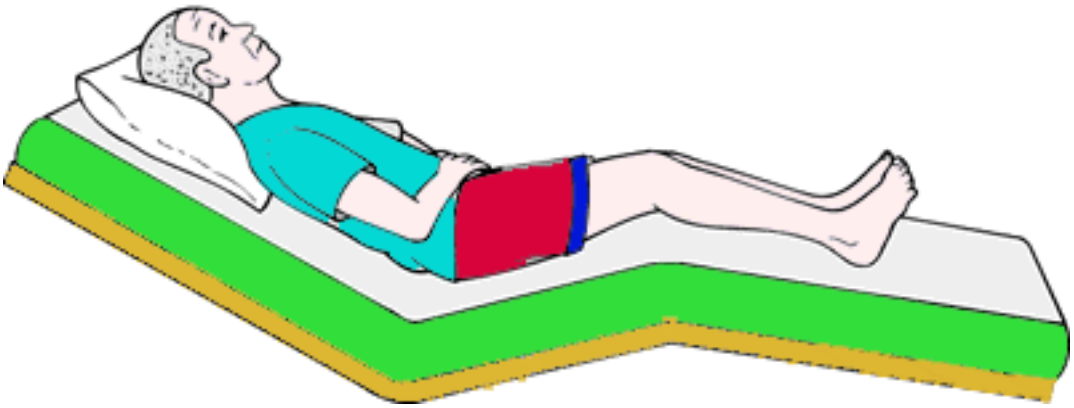

Image showing Reverse Trendelenburg position

The head is turned away from the surgeon, with the ear to be operated facing up. The patient is draped with a craniotomy type drape that has a large window to visualize the face.

Technique:

Transcanal approach is preferred unless the patient has a narrow meatus.

Transcanal approach:

In this procedure an anteriorly based tympanomeatal flap is elevated and the posterior aspect of the tympanic annulus is curetted to visualize the foot plate of stapes. Curetting of the

tympanic annulus should be continued till the horizontal segment of facial nerve; stapes foot plate and round window area should be fully visible.

The incus is removed first. The stapedius muscle tendon is cut and the supra structure of stapes is removed carefully. Small curettes are used to enlarge the oval window in its anterior and inferior aspects. The promontory between the oval and round windows are drilled in order to connect both the oval and round windows.

Close to the posterior end of the round window niche, the posterior ampullary nerve can be exposed and sectioned. The vestibule and basal turn of cochlea are exposed widely to create a common cavity. The utricle and saccule are scraped from the walls of the vestibule by using a right-angled pick. Probing is done to determine the locations of ampullae of semicircular canal.

After destruction of the end organ, the vestibule must be filled with gelfoam (soaked in gentamycin / streptomycin. Ear lobe fat can also be used to fill the cavity in lieu of gelfoam.

CSF leaks if any should be repaired with tissue seal. The tympanomeatal flap can be replaced against the posterior canal wall and the ear canal is packed with gelatin foam.

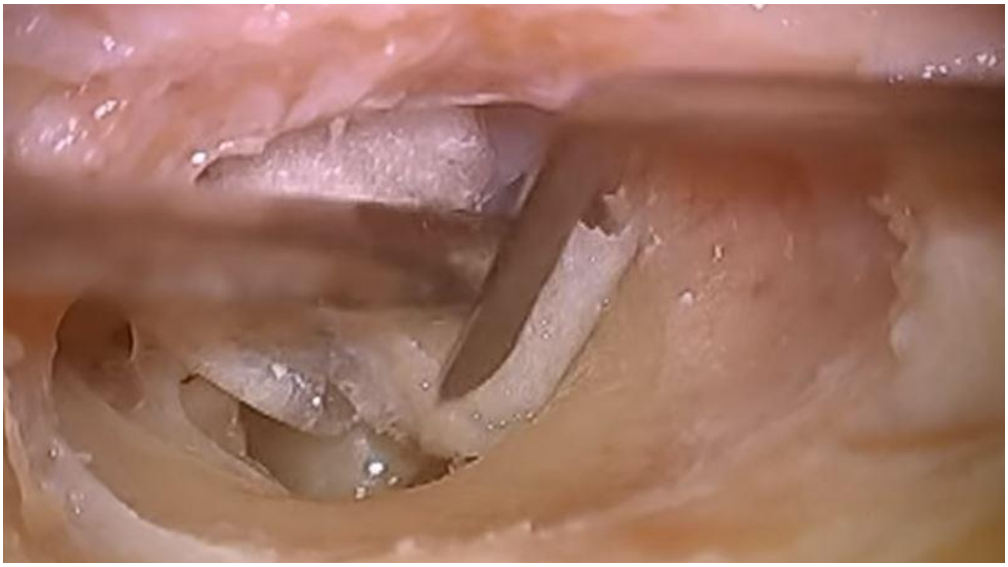

Image showing tympanomeatal flap being elevated

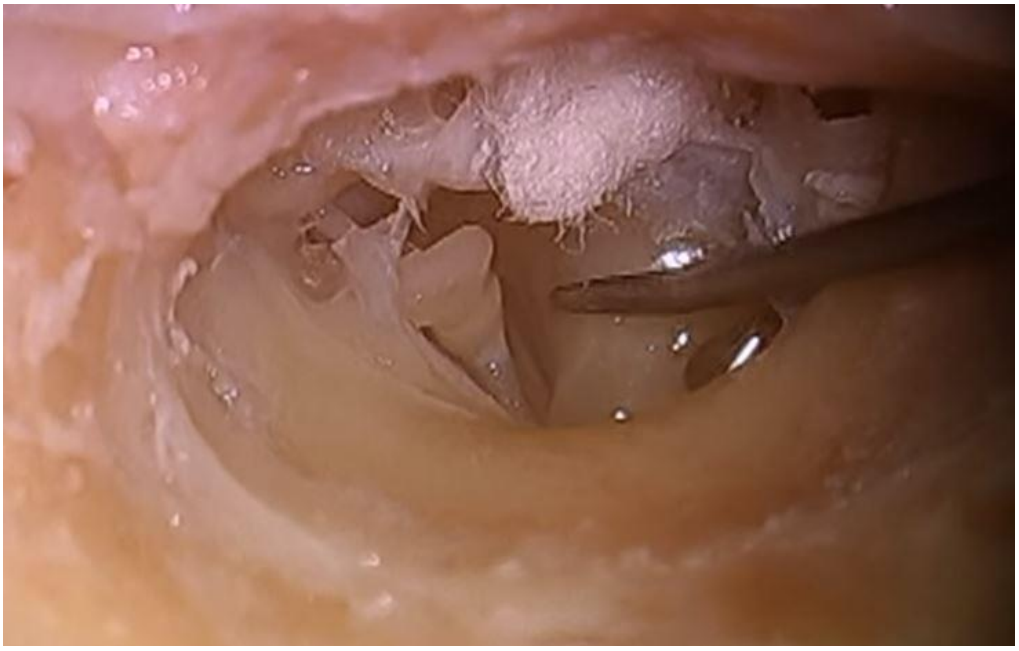

Image showing foot plate of stapes and round window

Transmastoid approach:

In this approach a post aural incision is used to expose the mastoid bone. Cortical mastoidectomy is performed with a largest possible cutting burr. The aditus is identified and widened. The short process of incus comes into view.

The superior and posterior peri labyrinthine air cell tracts and retro facial air cells are removed carefully to skeletonize the bony labyrinth. The facial nerve should be identified. The tegmen mastoideum is thinned out using a diamond burr. Usually medium cutting burrs are preferred on the bony labyrinth because the bone is very hard. Continuous suction irrigation is used to remove bone dust as drilling is continued. Care should be taken to provide continuous irrigation when the area over facial nerve is drilled.

Labyrinthectomy is started by drilling over the superior aspect of the lateral canal anteriorly and drilling is carried out towards the posterior canal. The lateral canal appears as a blue line. It is opened along its superior surface. The inferior surface should be preserved as a landmark for the facial nerve.

The drilling is continued in the posterior direction to open up the posterior canal. The drilling is continued superiorly until the common crus and superior canal is identified and opened. The neuroepithelia of the superior and lateral ampulla is identified anteriorly and the dense labyrinthine bone is removed to open up the vestibule.

The posterior canal is followed inferiorly and medial to the facial nerve to visualize the posterior canal ampulla. The portion of the posterior canal extending under the genu of the facial nerve should ideally be drilled with a diamond burr. The horizontal segment of the facial nerve is skeletonized.

While performing labyrinthectomy bone should be preserved in the following regions:

- Over the inferior wall of lateral canal, to protect the second genu of facial nerve
- Over the inferior wall of the posterior canal to protect a high jugular bulb
- Over the medial wall of the superior canal ampullae, to protect the facial nerve anterior to the superior vestibular nerve at the fundus of internal auditory canal

The surgery is complete when the neurosensory epithelium of the three ampulla, utricle, and saccule are visualized. After exposing all five portions of neurosensory epithelium, they should be removed with a sickle knife taking care not to rupture the underlying bony cribrosa.

Penetration in the cribrosa area can cause CSF leak. If there is a CSF leak it should be immediately repaired with a soft tissue seal on the table itself.

Attempt should always be made to remove every vestige of neuroepithelium because a viable remnant may give rise to spontaneous neuronal activity with continuing vertigo. Mastoid cavity is closed in layers.

Post op follow up:

Post op antibiotic is required. Antiemetic should be given routinely until nausea and vomiting ceases. Vestibular sedatives may also be needed in some patients for a few weeks.

Bandage can be removed / changed after 24 hours. Sutures can be removed on the 7^{th} post-operative day.

Patients should be gradually mobilized and physiotherapy exercises should be started. Patients should be encouraged to walk and take an active role in mobilization.

Patients should not drive until they are free from attacks of spontaneous vertigo for at least 3 months.

Image showing all the components of labyrinth opened up.

Complications:

CSF leak can occur when the cribrosa is fractured. This can be managed by sealing the vestibule with tissue graft / subcutaneous tissue.

Failure to locate the utricle is a possible complication. While aspirating the peri lymphatic fluid from the vestibule, the utricle usually retracts superiorly to lie medial to the horizontal segment of the facial nerve. This situation can be managed by the use of utricular hook. Removing bone from the inferior aspect of the oval window and connecting it to the round window improves access the vestibule.

The horizontal segment of facial nerve may be injured during transcanal labyrinthectomy.