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Labyrinthectomy for Meniere's Disease

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Surgical labyrinthectomy is a highly successful modality for the treatment of vertigo in patients with unilateral vestibular dysfunction and nonserviceable hearing most commonly from Meniere's Disease. Surgical ablation of the labyrinth may be accomplished through either a transcanal or transmastoid approach. We review the history of the procedure, the indications for surgery, the technical aspects for both types of labyrinthectomy, and surgical outcomes focusing on control of vertigo and postoperative complication rates. Either approach is safe and highly successful modality to control symptoms of vertigo in properly selected patients with unilateral vestibular dysfunction and nonserviceable hearing.

Introduction

Labyrinthectomy, either transcanal or transmastoid, is advocated as a successful surgical modality for uncompensated unilateral vestibular dysfunction in cases of nonserviceable hearing. The most common indication for labyrinthectomy is unilateral Meniere's Disease. The diagnostic criteria for Meniere's Disease were recently revised by the Equilibrium Committee of the American Academy of Otolaryngology (Table 1).[1] The procedure also has use for uncompensated unilateral labyrinthitis or unilateral vestibular dysfunction in the context of no usable hearing. The goal of labyrinthectomy is to surgically destroy the neuroepithelium from the semicircular canals and vestibule to eliminate abnormal vestibular input from a diseased ear. The physiological basis for peripheral vestibular ablation is that compensation may occur more successfully in the absence of a unilateral vestibular input when compared with unilateral disordered input such as in the case of unilateral Meniere's Disease disease. This article aims to describe the history, indications, technical aspects, and complication rates for both transcanal and transmastoid labyrinthectomy (Tables 2 and 3).

History

Ablation of the vestibular system in cases of uncompensated unilateral vestibular dysfunction was advocated by Dandy who used a selective nerve section of the 8 cranial nerve through a suboccipital approach for intractable Meniere's Disease.[2] The transmastoid labyrinthectomy was first described by Jansen[3] for treatment of a peripheral vestibulopathy after suppurative labyrinthitis. Lempert[4] introduced the transcanal labyrinthectomy procedure and advances by Schuknecht[5] led the current procedure described in this article.

Patient selection

Candidates for labyrinthectomy have unilateral severe to profound sensorineural hearing loss and clear evidence of unilateral vestibular dysfunction through formal vestibular testing. Patients should be knowledgeable about the development of bilateral Meniere's Disease disease in up to one-third of patients.[6,7] Pure-tone average of 70 db or

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Table 1 2015 Diagnostic criteria for Meniere's Disease[1]

Definite
A total of 2 or more spontaneous episodes of vertigo, each lasting 20 min to 12 h.
Audiometrically documented low frequency to midfrequency sensorineural hearing loss in single ear, defining the affected ear on at least 1 occasion before, during, or after 1 of the episodes of vertigo.
Fluctuating aural symptoms (hearing, tinnitus, or fullness) in the affected ear.
Not better accounted for by another vestibular diagnosis.
Probable
A total of 2 or more episodes of vertigo or dizziness, each lasting 20 min to 24 h.
Fluctuating aural symptoms (hearing, tinnitus, or fullness) in the affected ear.
Not better accounted for by another vestibular diagnosis.

greater and word scores of 30% or less are general guidelines for surgical selection at the House Ear Clinic.

Labyrinthectomy is contraindicated in the only hearing ear. In cases where surgical management is needed for an only hearing ear, we advocate for a hearing preservation strategy such as selective vestibular nerve section, endolymphatic shunt procedure, or chemical labyrinthectomy. These alternative procedures provide a realistic possibility of hearing preservation.

Preoperative counseling and consent

All hearing in the operative ear would be lost after the procedure. The opportunity for cochlear implantation exists after labyrinthectomy; however, obliteration of the cochlea, either partially or completely, occurs in approximately one-third of patients after labyrinthectomy during translabyrinthine resection of acoustic neuroma preventing many of these patients from the opportunity of successful cochlear implantation in the future.[8] Simultaneously, cochlear implantation and transmastoid labyrinthectomy may be considered for this reason.[9] Ablation of the labyrinth of an elderly patient or in a patient who depends on motor skills in the workplace is contraindicated.

Table 2 Key components of surgical consent

Tnnitus, if present, is unlikely to be affected by the procedure.
Rarely, tinnitus may worsen.
Vertigo and nausea are likely postoperatively requiring hospitalization.
Protracted vestibular symptoms may require physical therapy.
Patients should be informed about alternative therapies such as vestibular nerve section, chemical labyrinthectomy, and endolymphatic shunt procedures.
Standard complications of ear surgery such as infection, facial nerve injury, CSF leak, and failure of surgery to control vertigo symptoms.

Table 3 Potential advantages and disadvantages of each surgical procedure

Advantage	Disadvantage
Transcanal	
Less invasive, direct approach, shorter operative time	Limited exposure, possible higher incidence of incomplete labyrinthectomy, and higher incidence of postoperative imbalance
Transmastoid	
Improved exposure, less likely incomplete labyrinthectomy, lower incidence of imbalance, and possible simultaneous cochlear implantation	More invasive and greater operative times

Surgical technique

Transcanal and transmastoid labyrinthectomy approaches use general anesthesia owing to the risk of a vestibular response during surgery. Facial nerve monitoring is advocated for both approaches.

Transcanal approach

A transcanal approach begins with an anterior-based tympanomeatal flap (Fig. 1A). Curettage is then used to adequately visualize the oval and round windows. The horizontal facial nerve must also be visualized. The incus is separated from the incudostapedial joint (Fig. 1B). The incus is removed. The stapedius is cut. The stapes are then removed from the oval window (Fig. 1C). To access the vestibule, the oval window is enlarged using anteriorly and inferiorly. If greater exposure is needed, the oval and round windows may joined by removing a segment of the promontory (Fig. 1D). The posterior ampullary nerve should be encountered at this point in drilling at the posterior edge of the round window niche. The nerve should be sectioned to assure a compete labyrinthectomy.

To achieve destruction of the 5 vestibular end organs, first the utricle is removed with a 4-mm hook from the superior aspect of the vestibule (Fig. 1E). Removal also targets the ampulated ends of the superior and lateral semicircular canals. The saccule is then ablated by aspiration of the medial vestibule. Overaggressive manipulation of the vestibule at this location can results in cerebrospinal fluid (CSF) leakage from the internal auditory canal. Mechanical probing with a 4-mm hook into the ampulated end of the posterior canal completed the labyrinthectomy (Fig. 1F). The use of gentamycin soaked gelfoam packed into the vestibule followed by fat is advocated by some surgeons (Fig. 1G). The tympanomeatal flap is then returned into position the ear canal is packed with gelfoam.