



EAR SURGERY— An Overview

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PART 2 OF 2

In the first half of this article, published last month, the author presented an overview of ear anatomy, the physiology of hearing, and the instrumentation, equipment and supplies typically used in ear surgeries. Following this overview was a discussion of two commonly performed types of ear surgeries: myringotomy with tympanoplasty tube insertion and tympanoplasty.

This month's article continues with a discussion of ossicular reconstruction, tympanomastoidectomy and stapedectomy. The first two procedures can become necessary to perform during a tympanoplasty, so the surgical technologist must be aware of them. Please refer to last month's article for the procedural details of a tympanoplasty procedure.

OSSICULAR RECONSTRUCTION

Reconstructive surgery to repair damage to or a break in the ossicles is often performed in conjunction with a tympanoplasty. In some cases, the need for bone reconstruction is known prior to surgery. In other cases, though, the damage—or the extent of the damage—is unknown until the surgeon is able to view the area under microscope.

Damage to the ossicles can be congenital or caused by injury, infection, disease or cholesteatomas (keratinized squamous epithelium), which are highly destructive to bone and can grow in the middle ear and mastoid. Once cholesteatomas are diagnosed, surgery should be performed as soon as possible to prevent serious injury to the ossicles.

INDICATIONS FOR SURGERY

Ossicular reconstruction is contraindicated by the presence of infection or cholesteatoma. Antibiotics and frequent cleaning are typically prescribed for the infection. Once the infection has been treated successfully, a decision can be made regarding surgery to remove the cholesteatoma. In some patients, it is necessary to repeat the procedure several times to ensure complete removal of all cholesteatomas.

PROCEDURAL OVERVIEW

Ossicular reconstructions require the same instrumentation and set-up as a tympanoplasty.

Reconstruction is typically performed under general anesthesia, although local anesthesia with intravenous sedation may be given. If local anesthesia is used, the patient must be kept very still throughout the entire procedure. Therefore, the patient's age and ability to comply must be considered. Surgeon or anesthesiologist preference and the patient's physical health are also factors.

The choice of prosthesis depends on which, if any, ossicles remain intact and viable.



Often, the incus can be removed, resculpted and then replaced, if the stapes and part of the malleus are present. This procedure is called incus interposition. Doctors may save the incus in cases of cholesteatoma either in the mastoid bowl (after a mastoidectomy) or by freeze-drying it for a later procedure involving an incus interposition.

Allografts, produced from materials such as bioglass, hydroxyapatite, or plastipore (high-density polyethylene), may be used. These grafts are called either partial or total ossicular reconstruction prostheses (PORP or TORP, respectively).

A PORP is used when the stapes arch is intact and functioning properly. The prosthesis is fit on the stapes head, and the tympanic membrane rests over it.

A TORP is used when only the stapes footplate remains. The prosthesis rests on the footplate, and the tympanic membrane rests over it.

The choice of a PORP or TORP is determined by the surgeon. Due to the size and delicate structure of the implants, it is advisable to have at least two of each size prosthesis available.

Moist absorbable gelatin is often used to support the graft. A tragal cartilage graft also may be used to help support the tympanic membrane.

POTENTIAL COMPLICATIONS

Postoperative challenges include prosthesis dislodgement or failure, tympanic membrane perforation, and perilymph leak around the stapes footplate (if a TORP was used).

TYMPANOMASTOIDECTOMY

Tympanomastoidectomy is removal of a portion of the mastoid bone and repair or reconstruction of the tympanic membrane. The goal of tympanomastoidectomy is to expose disease, remove diseased tissue as necessary, and reconstruct the sound-conducting mechanism, leaving the anatomy intact, if possible.

INDICATIONS FOR SURGERY

Tympanomastoidectomy is indicated for diseases of the mastoid portion of the temporal bone, most often cholesteatoma. An acute infection of the mastoid may require an emergency mastoidectomy, because a brain abscess can occur (due to close proximity) if the infection is not treated immediately. A myringotomy may be performed to relieve acute mastoiditis, but a mastoidectomy often becomes necessary eventually.

SET-UP AND PREOPERATIVE CONSIDERATIONS

The set-up for a tympanomastoidectomy is the same as that used for a tympanoplasty, with the addition of an ear drill (surgeon preference, with cutting and diamond burrs of various sizes and

configurations), as well as the surgeon's preferred mode of irrigation, typically either on the drill or via a suction irrigation tip attached to irrigation tubing, and saline.

Surgeons also may use a drain, such as a 7-mm Jackson-Pratt, in the mastoid bowl after doing a mastoidectomy for acute mastoiditis.

Several key areas must be preserved while performing a mastoidectomy. The sigmoid sinus, which drains into the internal jugular vein, is located in the inferior portion of the mastoid. Most surgeons leave a thin layer of bone over the sinus while performing the mastoidectomy. If the sigmoid sinus is inadvertently entered, there may be a great deal of blood loss. The perforation in the sinus will likely be packed with oxidized cellulose or dry absorbable gelatin.

Next is the facial nerve, which runs through the mastoid bone and the middle ear to innervate the face. The tract where the nerve lies is under the ear canal wall in an area called the facial recess. Surgeons will drill out this area to find the nerve, typically while using a facial nerve monitor to prevent damage.

The third key area is the dura mater, located directly below the mastoid.

The ear canal wall is another key area of anatomy. The canal wall may be taken down during a mastoidectomy if needed, but most often a thin wall will be left. The surgeon is careful not to make a hole in the wall.

PROCEDURAL OVERVIEW

The surgery is typically performed via a postauricular approach. Some surgeons use a small penrose drain to protect the vascular strip they create inside the canal. They generally place the drain through the ear canal and out the postauricular incision, clamping the drain above the auricle. A mastoid retractor or Weitlaner is used to retract the auricle.

If performing a radical mastoidectomy, the surgeon may enlarge the auditory meatus to facilitate regular cleaning of the mastoid area. Usually this is done for patients with chronic mastoiditis.

If cholesteatoma is present, the tympanomastoidectomy may be staged to check for residual

disease, and an ossicular reconstruction will be scheduled for a later date, if necessary.

Following wound closure, a mastoid dressing will be applied.

POTENTIAL COMPLICATIONS

Possible complications of tympanomastoidectomy include infection and damage to the facial nerve, sigmoid sinus or dura mater.

STAPEDECTOMY

Stapedectomy involves removal of a nonfunctioning stapes and reconstruction of its function with an artificial replacement.

INDICATIONS FOR SURGERY

A stapedectomy is indicated for loss of hearing typically resulting from otosclerosis, a condition in which the ossicles become immobilized over time. In the case of the stapes, the otosclerosis interferes with the bone's ability to vibrate properly.

INSTRUMENTATION

The stapedectomy set-up is the same as for a tympanoplasty with the addition of a stapes drill. Also, the topical adrenaline dosage may be more concentrated to ensure hemostasis is achieved, as too much blood in the wound obstructs the surgeon's vision.

The stapes prosthesis is shaped like a piston with a hook on top. The hook fits over the incus, and the piston fits into the hole made by the surgeon in the stapes footplate.

Instruments commonly used for stapedectomy include the strut guide and the crimper. The groove on the strut guide is used to push the hook of the prosthesis over the incus, and the crimper is used to close the hook over the incus.

PROCEDURAL OVERVIEW

Many surgeons prefer that the patient be awake for this procedure. This allows for communication with the patient, which helps the surgeon determine what can be accomplished during the surgery. Patients are typically asked whether or not their hearing has improved following certain actions taken by the surgeon.

They are also asked whether or not they feel dizzy or nauseous during the procedure. If the prosthesis is too long, the stapes footplate will be pushed too far down, and the patient will immediately feel dizzy and/or nauseous. If this occurs, the surgeon may abort the procedure.

Another reason to abort is a dehiscient facial nerve, which is usually covered with a layer of bone. In some patients, though, the nerve is not covered and is lying free in the middle ear. In these cases, the surgeon may elect not to perform the stapedectomy, due to the risk of facial nerve injury.

The surgeon may use a muscle or fascial plug to pack the hole in the stapes footplate created earlier. The surgeon then replaces the tympanic membrane and places a cotton ball in the ear for dressing.

POTENTIAL COMPLICATIONS

Complications of stapedectomy include otitis media (rare, but may lead to bacterial meningitis due to the hole in the stapes footplate), granuloma of the oval window, perilymph fistula, sensorineural hearing loss, loose prosthesis wire, and incus necrosis (resulting from the hook being crimped too tightly).

LESS COMMON EAR PROCEDURES

There are several other types of ear procedures, which are less commonly performed. Only a brief overview of two types of these procedures will be presented in this article. With the basic knowledge of the preceding surgeries, a surgical technologist will be capable of setting up and scrubbing for other related procedures.

An exploratory tympanotomy is essentially the same as a tympanoplasty, but without the reconstruction of the eardrum. It is usually performed to verify the presence of cholesteatoma or to examine an unknown pathology in the middle ear. An exploratory tympanotomy is the approach used for stapedectomies and ossicular reconstruction without mastoidectomy or tympanoplasty.

Cochlear implant surgery, indicated for bilateral sensorineural deafness, requires extensive patient preparation prior to surgery. The procedure is performed via a mastoidectomy with a facial recess. A hole is made near the round window of

the cochlea, and the implant tail, which consists of electrodes, is inserted. The electrodes restore hearing by stimulating the acoustic nerve in the cochlea. The implant is programmed via computer at a postoperative followup appointment.

An endolymphatic shunt procedure may be performed if a patient suffers from perilymph fistula and more conservative approaches were unsuccessful. However, opinions on fistula diagnosis and treatment vary significantly among surgeons, so this procedure is not often seen by surgical technologists.

ABOUT THE AUTHOR

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