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Procedures

Middle Ear Surgery: Pointers and Pitfalls

Stapedectomy

Careful preoperative selection of patients is one of the most important aspects to avoid complications. First, accurate audiology is essential. Audiological studies can contain inaccuracies as a result of machine, human, or calibration error. The otolaryngologist can use tuning forks judiciously to efficiently check results of the audiology. The 256, 512, and 1024 tuning forks, used in conjunction, can determine the degree of conductive hearing loss. In this way, otolaryngologists can operate on patients who have conductive hearing loss, not nerve hearing loss, which naturally leads to better results.

The 256 tuning fork gives a negative result (positive is normal) if the air-bone gap is greater than 15 dB. The 512 tuning fork gives a negative result if the air-bone gap is greater than 25 dB. The 1024 tuning fork is negative if the air-bone gap is greater than 30 to 35 dB. Ideally, all three forks are used in conjunction. However, if only one of the forks can be used, it should be the 512 fork. The 256 fork can be less accurate because it tests low frequencies, which are the same as the ambient noise in an office. More importantly, the 256 fork gives a negative result if the air-bone gap is greater than only 15 dB. A 15 dB air-bone gap should never be an indication for a surgical procedure to improve hearing. Stapedectomy should be performed when the air-bone gap is greater than 25 dB; therefore the 256 test alone indicates surgery more often than is optimal.

The 512 tuning fork, on the other hand, tests negative for someone who has an air-bone gap of 25 to 30 dB or greater and who could be helped by a stapedectomy. Because the 1024 tuning fork by itself indicates surgery less often than is optimal, the best surgical indicator is the 512 tuning fork.

Examination of the tympanic membrane

Occasionally, a patient will have a conductive hearing loss of 30 dB, but a tympanic membrane that is not perfectly normal. In this case, if the conductive hearing loss is due to otosclerosis, Stapedectomy is indicated. But if hearing loss is due to poor eustachian tube function and poor tympanic membrane mobility, a stapedectomy will not help. This differentiation can be achieved in the office using a microscope and the Siegel otoscope. When the tympanic membrane is massaged gently, if the eustachian tube and the tympanic membrane are functioning normally, the tympanic membrane fibrates freely. If, however, the eustachian tube is dysfunctional, this will be seen under the microscope coupled with the Siegel otoscope.

The Siegel otoscope comes with its own magnifying glass. It is impossible to achieve a focused image when the magnifying glass is coupled with the microscope. Thus, when purchasing a Siegel otoscope, specify that the magnifying glass should be changed to a clear glass.

Barany noise box

If a patient has a negative Rinne test, it is possible that he is actually hearing through the non-tested ear. When using a tuning fork, it is important to mask the normal ear. The Barany noise box is an excellent device to mask the non-tested ear, making it possible to hear the tuning fork through the appropriate ear only.

It is also important to determine if the malleus is mobile by massaging the tympanic membrane under a Siebel otoscope and microscope. If the malleus is mobile, a normal stapedectomy can be performed, consisting of an incus to oval window prosthesis. This operation has a high rate of success (95%). If the malleus is fixed, however, it is necessary to create a malleus to oval window prosthesis. Because this procedure is harder to perform, the success rate for complete air-bone gap closure declines to about 75%. The failure of surgery may not be due to poor surgical technique but rather to patient selection. A patient who needs a malleus to oval window prosthesis should be cautioned that the operation is not always entirely successful. The air-bone gap of 30 dB may not be closed completely but only reduced to 10 dB.

When it is impossible to get a tight seal to massage the tympanic membrane, the otolaryngologist can, under the microscope, warn the patient that it might hurt a little and use the blunt end of the Rosen needle to palpate the malleus for mobility.

Age limit

There is no upper age limit for stapedectomy, provided the patient is in good health and surgery is performed under local anesthesia. My oldest patient is 82 years of age. There may be a lower age limit, however. Some otolaryngologists believe that operating on juvenile otosclerosis results in a higher rate of sensorineural hearing loss. Others believe that juvenile patients have a tendency to refixate, necessitating a revision stapedectomy. The success rate of revision stapedectomy is 10% to 15% lower than of the original, or virgin, stapedectomy. Therefore, some conclude that young patients should not be subjected to the risk of sensorineural hearing loss or refixation and are not good candidates for stapedectomy.

There are, however, other otolaryngologists who believe children are no more at risk for sensorineural hearing loss or refixation than adults after stapedectomy and are therefore not necessarily worse candidates for surgery. Surgeons must use their own judgment in this matter. Personally, I would be wary of performing a stapedectomy on a patient younger than 14 years of age.

Meniere's Disease

When a patient has Meniere's disease, there is a swelling of the endolymph or endolymphatic hydrops. During stapedectomy, the saccule may be punctured, which can result in a dead ear or sensorineural hearing loss. In rare instances when a patient has both otosclerosis and Meniere's disease, I choose not to operate and recommend a hearing aid instead.

Osteogenesis imperfecta

Patients who have osteogenesis imperfecta with blue sclera have brittle bones and should be treated carefully. When curetting the posterior-superior bony canal, it is easy to fracture the tympanic ring or damage the facial nerve. When crimping the wire on the incus, be careful to crimp tightly without fracturing the long process of the incus. If the long process of the incus is fractured, then the difficult to apply malleus to oval window prosthesis is needed.

Surgical procedure

Stapedectomy is a simple straightforward operation. A professor once told me, "Stapedectomy is the easiest operation, yet it is the hardest operation." If hemostasis is achieved, the patient is positioned correctly, and the procedure skillfully executed, stapedectomy is a painless operation for the surgeon and patient with a success rate of 95%. However, if there is bleeding or other complications, one problem can lead to another and the operation becomes a disaster. Unlike a radical neck dissection, no one can assist the surgeon in a stapedectomy.

Therefore, potential problems should be minimized. For example, if the patient has a small ear canal or exostosis, the operation should be staged. The canalplasty should be done first, enlarging the canal and allowing it to heal. Three months later, the stapedectomy is performed.

Blind patients

A seeing patient suffering minor vestibular complications resulting from stapedectomy can compensate. A blind patient with a vestibular problem cannot compensate. A blind patient with otosclerosis therefore is not a good candidate for surgery and should wear a hearing aid.

Diagnostic dilemmas

Two types of patients are (a) one with an air conduction threshold of 95 dB and (2) one with a descending audiometric curve. Each creates its own type of diagnostic dilemma. The one with the 95 dB threshold has a bone conduction threshold of about 60 dB. But because of the limitations of the audiometer, a true bone conduction threshold cannot be established. The discrimination score, 15% in the right ear and 20% in the left ear, is so poor that theoretically this patient is not a good candidate for surgery. Actually, the poor discrimination is again a function of the limitations of the audiometer testing a patient with an air-conduction threshold of 95 dB; static and distortions are produced. The problem is the audiometers, not the patient's. When the bone conduction is 60 dB and the air conduction is nearly off the audiometer scale, the patient is simply beyond the testing capability of the equipment.

For these patients, the surgeon should use the following criteria. Does the patient have normal speech? If this were truly a sensorineural hearing loss, the patient would have an abnormal speech pattern, like a cochlear implant candidate. If there is normal speech, the patient is monitoring speech through bone conduction. In this case, using the tuning fork with the Barany noise box masking the contralateral ear becomes an important diagnostic test. If the tuning fork gives a strongly negative Rinne at 512 and 1024 with the Barany noise box masking the contralateral ear, then the patient, if in good health, is a good candidate for stapedectomy. Even so, the patient must be advised that a hearing aid will be necessary after surgery, because all the surgery will do is successfully reduce a 95 dB threshold to 55 dB.

The other diagnostic dilemma is the patient with a descending bone conduction curve, a flat air-conduction curve, a speech reception threshold (SRT) of 65, a 40 dB air-bone gap, and a discrimination of 85%. Even if a perfect stapedectomy is performed and the air-bone gap is closed, the patient will hear better on SRT or pure tone average, but because of the sloping type of curve the discrimination will drop to 30% to 40%. The patient will hear better but less distinctly. This does not automatically rule out the operation, but the patient must be cautioned that discrimination may drop as a result of it.

Positioning the patient

When performing a stapedectomy, it is important to position the patient properly. To see the protympanum anteriorly, raise the table and rotate the patient forward. To view posteriorly, lower the table and rotate the patient toward the surgeon. To see the attic superiorly, lower the head of the patient. To see the hypotympanum, raise the head of the patient.

When injecting the tympanomeatal flap, use a no. 30 needle, a very fine needle, and inject slowly so that the injection can be administered with less pain. Xylocaine with 1:100,000 epinephrine is injected into the tympanomeatal flap during stapedectomy for hemostasis and anesthesia. Also, the operation should not be started immediately after the injection; wait 10 to 15 minutes to obtain better hemostasis.

For anesthesia and not for hemostasis, such as removal of a foreign body on an outpatient basis, Xylocaine should be injected only into the bony cartilaginous junction. If Xylocaine is injected only into the bony cartilaginous junction, the solution will not get into the middle ear and yet the necessary amount of anesthesia will be achieved. This is important for an office procedure, for if the solution entered the middle ear, the patient could have a dehiscent facial canal and would suffer temporary facial nerve paralysis. This would last for only an hour or two but can be worrisome for the patient and the doctor.

If Xylocaine were to cross the round window membrane from the middle ear into the inner ear, the patient would become vertiginous. The latency between introduction of solution and onset of vertigo is approximately 45 minutes. For an in-the-office procedure such as putting in pressure equalizing tubes, 45 minutes later could be when the patient is driving home. When performing an office procedure, the surgeon should be sure to inject Xylocaine into the bony cartilaginous junction, not the tympanomeatal flap, to avoid solution getting into the middle ear.

Potential pitfalls

One possible complication of turning the tympanomeatal flap is perforation of the tympanic membrane. To avoid perforating the tympanic membrane, elevate the fibrous annulus.

If the patient has a mildly dehiscent facial nerve, the stapedectomy can be performed by bending the wire (Figure 1). Either a 36-gauge or 38-gauge wire can be used. The House Strut-gut can be used to hold the loop of the wire, while the wire is being bent with the 1 mm hook. Thus the stapedectomy can still be successful with a mildly dehiscent facial nerve.

If the facial nerve is very dehiscent, then the stapedectomy has a lower chance of success and that particular patient is not a good candidate for surgery. Possible results of operating on a patient with a very dehiscent facial nerve are facial paralysis, sensorineural hearing loss, and dizziness.

When crimping the stapes wire, make sure that it is crimped all the way around so that it does not fall off. Figure 2 shows three crimped stapes wires. The left one is perfectly crimped. The middle one is acceptable because the wire will not fall off. The right one, however, is unacceptable because with vibrations and movement it will fall off.

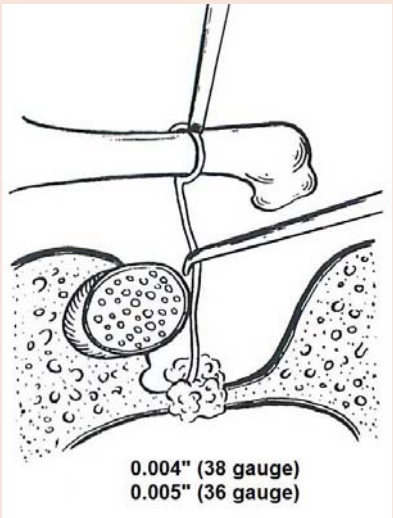

Figure 1: If patient has a mildly dehiscent facial nerve, stapedectomy can still be done by bending the wire.

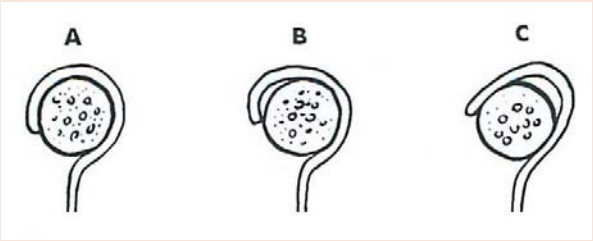

Figure 2: A. perfectly crimped stapes wire. B. Satisfactory crimped stapes wire. C. Improperly crimped stapes Wire.

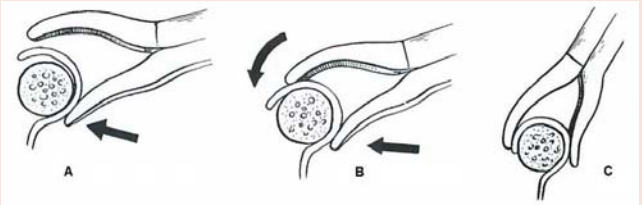

Figure 3: Crimping the stapes wire. A. Push posterior arm of the forceps forward. B. Rotate forceps. C. Complete the crimp.

Crimping is achieved in three motions:

1. The posterior arm is pushed forward (Figure 3A)
2. The forceps is rotated (Figure 3B)
3. The crimp is completed (Figure 3C)

When removing a floating footplate, a common maneuver is to drill a small hole next to the footplate, insert a small 0.3 mm hook into the hole, and tilt the footplate out. However, it is usually not necessary to drill a hole. If the surgeon is careful, it is possible to slip a 0.3 mm hook parallel between the footplate and the fibrous annulus, which suspends it, and then tilt the footplate out.

Immediate vertigo after stapedectomy is the result of perilymph loss from suctioning. Vertigo can also be caused by leakage of perilymph fluid because the tissue plug does not give a perfect fit. Because of the shape of the oval window niche, a large tissue plug may give the appearance from the surgeon's view of sealing the oval window, even though there are small leaks medial to the plug that the surgeon cannot see from his angle. If in doubt, a tissue plug that is too small is better, followed by plugging all the remaining fistulas with smaller pieces of tissue until a tight seal is achieved. Ideally, a snug piece of tissue plug, fitting just right, should be used.

Revision stapedectomy

When removing the prosthesis, decompress by making a few tiny holes to avoid a suction effect, which would damage the inner ear.

Malleus to oval window prosthesis

The malleus to oval window prosthesis is a more difficult operation than the incus to oval window prosthesis. Whereas the average length of an incus to oval window prosthesis is 4 mm, the average length of

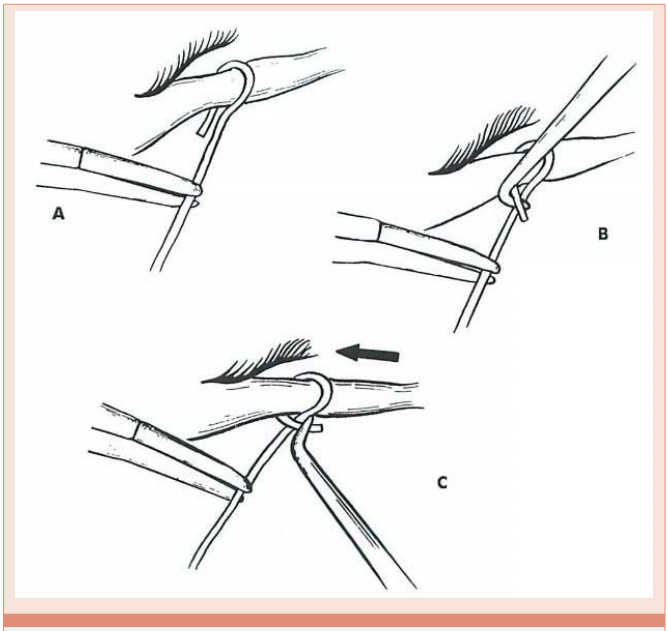

Figure 4: Malleus to oval window prosthesis. A. Hang prosthesis on the malleus. B. Tie knot with a hook. C. Slide prosthesis wire to thicker section of bone to give a snug fit.

the malleus to oval window prosthesis is 5.5 mm. First, the prosthesis, shaped like a paperclip, is hung on the malleus. At this point, the surgeon does not need to worry where the other end falls (Figure 4A). Next, the wire is held with a smooth alligator forceps, while a knot is tied using a hook. It is important that only smooth alligator forceps be used for handling the wire. Although the serrated alligator forceps are good for handling tissue, the wire can get caught by the serrations and be difficult to release (Figure 4B). Because it is impossible to tie the wire perfectly tight, tie the knot as tight as possible on a thinner portion of the bone and then slide the prosthesis wire to a thicker section of bone, giving a snug fit (Figure 4C). Subsequently, the wire is bent to fit into the oval window.

Mastoid-Tympanoplasty

Common pitfalls of mastoid-tympanoplasty include the following:

1. Postoperative meatus or canal may be too small.
2. Too little skin grafting to help epithelization, or the cavity is too big.
3. Packing may cause more granulation tissue, and when removed leads to more scar tissue.

If these problems can be solved by having a large meatus, a large canal, and a regional skin flap that is well vascularized, the patient will heal faster. A muscle graft can be used to minimize the size of the cavity.

A criticism of using muscle graft to minimize size of the cavity is that the muscle used to obliterate the cavity could bury cholesteatoma. The solution is simple: in cases with extensive cholesteatoma, the musculoplasty should not be performed. One cannot bury cholesteatoma; the muscle can be placed to minimize the cavity only where there is no cholesteatoma. This does not usually pose a problem because most cholesteatoma is located in the antrum and superiorly, while the musculoplasty is placed inferiorly to fill in the mastoid tip region. In rare cases in which the cholesteatoma is located inferiorly, the musculoplasty should not be performed.

The second criticism of the musculoplasty technique is that the muscles will not survive, they will atrophy, thereby making it impossible to completely obliterate the bony cavity. This criticism is correct. The goal of musculoplasty, however, is to form the cavity and the ear canal into more of a cylindrical, instead of an hourglass, shape to minimize the cavity, not obliterate it entirely (Figure 5).

Within the last year, we have adopted another method to achieve a safe, dry ear after a canal wall down mastoidectomy with tympanoplasty. This technique was described by Dr. Van Hasselt at the Chinese University in Hong Kong. In this technique, he developed a large temporalis fascia graft which is attached anteriorly and rotated inferiorly to line the epitympanum, the antrum, the facial ridge, and also serve as a tympanoplasty graft (Figures 6-8). The posterior

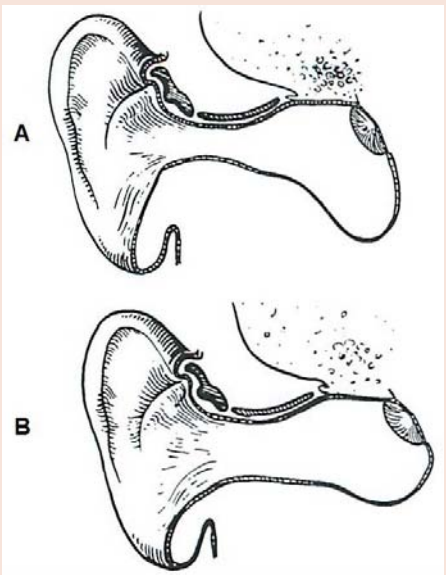

Figure 5: Goal of musculoplasty is to make cavity into a cylindrical shape (B) instead of an hourglass (A).

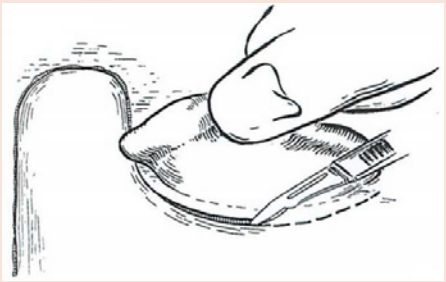

Figure 6: Skin incision for the "Hong Kong" flap.

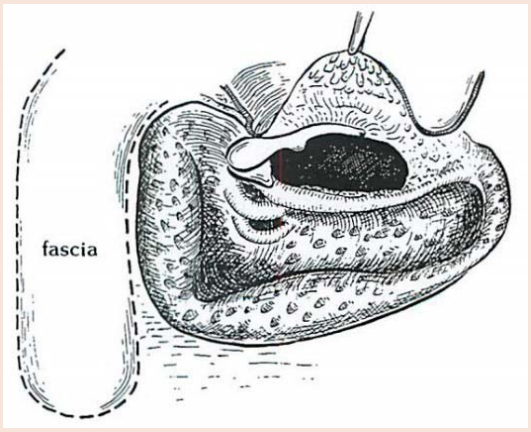

Figure 7: Outline of pedicle temporalis fascia flap.

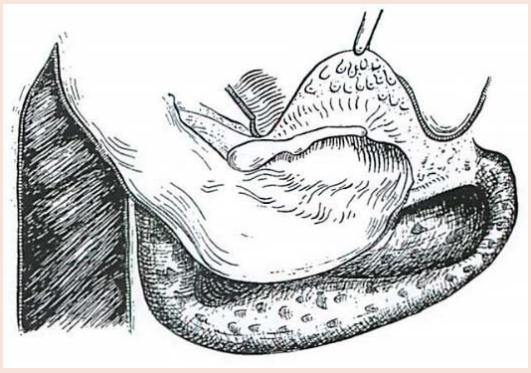

Figure 8: Pedicle temporalis fascia flap in position.

inferior portion of the temporalis fascia also lines the sigmoid sinus area and around the mastoid tip region. This flap survives well because it is a flap with an attached vascular supply. It goes without saying that this flap should not be used if there is any residual cholesteatoma. The author of this article has found this technique very useful particularly in revision cases. In the case of a CSF leak, temporalis muscle is used to seal the leak, then this pedicle temporalis fascia graft is rotated to lie over the muscle graft.

Potential pitfalls

In mastoidectomy, problematic areas include the following:

1. Epitympanic space
2. Zygomatic root cells
3. Sinodural angle
4. Perilabyrinthine cells
5. Facial recess
6. Sinus tympani
7. Mastoid tip
8. Protympanum
9. Hypotympanum

These are areas in which the cholesteatoma can be hidden from view; therefore, the surgeon should remember these areas, position the patient to see all areas clearly and meticulously clean them.

When performing a mastoidectomy on a child under 2 years of age, the postauricular incision should not follow the postauricular crease because the facial nerve is superficial as it descends toward the stylomastoid foramen and the tympanic ring is yet to be ossified. A typical postauricular incision would most surely damage the facial nerve. Thus, the incision is made to swoop out, as shown in Figure 9.

When performing a simple mastoidectomy in a child or in an adult such as for facial nerve decompression, the concha could fall forward postoperatively, thereby giving a hearing loss as a result

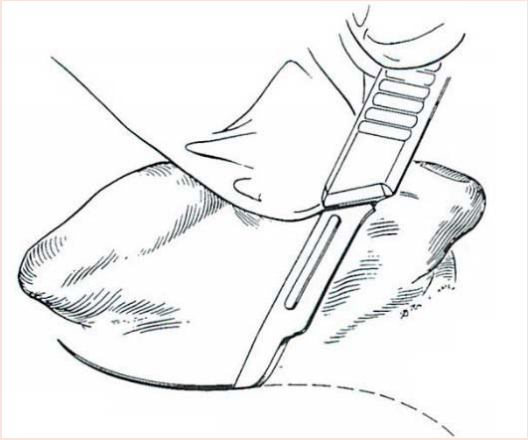

Figure 9: Postauricular incision is made to swoop out.

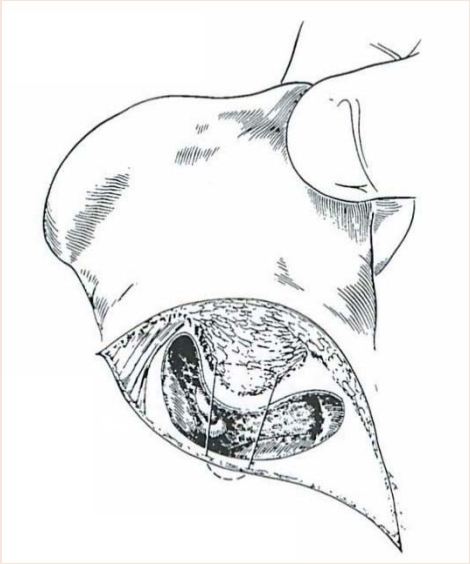

Figure 10: Place a stitch through the cartilage and suture it to the posterior subcutaneous edge to avoid conchal collapse, after the posterior canal wall skin is elevated from the bony canal.

of conchal collapse. A stitch placed through the cartilage with 3-0 chromic or Dexon, looping around like a mattress stitch, and sutured to the posterior subcutaneous edge, will avoid this (Figure 10).

Figure 11 shows a nature's myringostapediopexy. This patient may have very little hearing loss if the eustachian tube has normal function, in which case it would not be wise to operate. Even though the tympanic membrane looks atrophic, the patient hears well. If the patient has had eustachian tube function, and there is a lot of scar tissue (Figure 12), no matter how many operations are performed, the result will be poor hearing. Therefore in the case of poor eustachian tube function, provided the patient has no infection and a dry ear, a hearing aid is appropriate rather than surgery. Also, if the patient has fibrosis of the middle ear or has an atelectatic tympanic membrane, surgery will not be successful. Preoperative selection of patients is paramount in achieving good results.

Facial nerve landmarks

The facial nerve is anterior to the horizontal semicircular canal and posterior to the cochleariform process. If the epitympanum is pictured as a box, its sides are the anterior wall, posterior wall, superior wall, inferior wall, medial wall, and lateral wall. The medial wall of the epitympanum is the place where the geniculate ganglion is located, along with the facial nerve. When removing cholesteatoma from the epitympanum, the surgeon should not scrape on the medial wall and should be gentle.

Figure 11: Nature's myringostapediopexy.

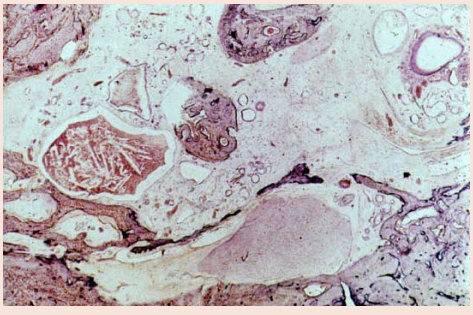

Figure 12: Histopathological slide shows cicatricle tissues in middle ear obstructing Eustachian tube.

In badly diseased ear after multiple operations and with no landmarks, the promontory of the middle ear has a groove, which is where Jacobson's nerve lies. This groove always proceeds from the round window to the cochleariform process. If all else fails, find the groove, which shows where the round window is and leads to the cochleariform process. Posterior to the cochleariform process by a few millimeters is the facial nerve. This route will help identify the facial nerve.

Surgical Procedure

The incision should be made one-half centimeter behind the postauricular crease to avoid the appearance of a plastered auricle or a depression in the crease (Figure 13).

When the incision is carried through the full thickness of skin, the subcutaneous and fibrous tissue is dissected to the junction of the cartilaginous and bony canal, using the bovie coagulation cautery set at no. 4 on the Valley Laboratory SSE2-K machine. If the machine is set on the coagulation setting, rather than the cutting setting, maximum hemostasis will be achieved. Remember to retract the auricle anterolaterally, applying the principle of traction and counter traction to make dissection easier (Figure 14).

A 6 to 12 o'clock incision is then made along the posterior bony canal, 3 mm to 5 mm lateral to the fibrous annulus. A round knife or a lancet knife is appropriate for this step of the procedure (Figure 15).

The Korner flap, used in this procedure, is a posterior full thickness flap based laterally at the concha. To create the Korner flap, make an incision from this incision (Figure 15) to the helical crus (without cutting into it), staying as close to 12 o'clock as possible to obtain a broad pedicle flap. Because of the thicknesses of the cartilage and soft tissue, it is most effective to use a fresh sharp blade and cut in a gentle see-saw motion. Too firm a push to cut through the dense tissue might end up transecting the auricle. A similar incision is made inferiorly at the 6 o'clock position (Figure 16).

The see-saw technique is facilitated by holding the auricle anterolaterally. The Korner flap is released by cutting the superior and inferior attachments to the concha with a pair of curved Stevens scissors (Figure 17).

The Korner broad-based pedicle flap is shown in Figure 18. Excess adipose-connective tissue should be trimmed off with a no. 11 blade. Countertraction can be provided with a mosquito snap, but the surgeon should take care not to "button-hole" the flap.

Using a no. 15 blade, remove a generous crescent of the conchal cartilage while pushing the index finger posteriorly in the external auditory meatus, thus effecting a wide meatoplasty. Again, be careful not to button-hole the pedicle (Figure 19).

The inferiorly based muscle pedicle flap is made with the coagulation current setting at no. 4 on the Valley Laboratory SSE2-K machine.

Figure 13: Post auricular incision is made one-half centimeter behind postauricular crease.

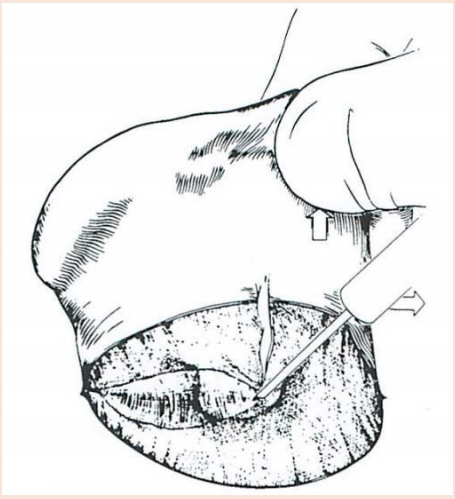

Figure 14: Subcutaneous and fibrous tissue is dissected to junction of the cartilaginous and bony canal using Bowie coagulation cautery.

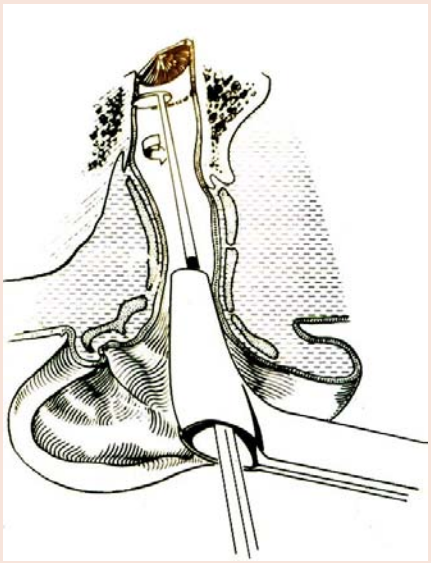

Figure 15: Subcutaneous and fibrous tissue is dissected to junction of the cartilaginous and bony canal using Bowie coagulation cautery.

Figure 16: Incision made at the 6 and 12 o'clock positions to the helical crus creates the Korner flap.

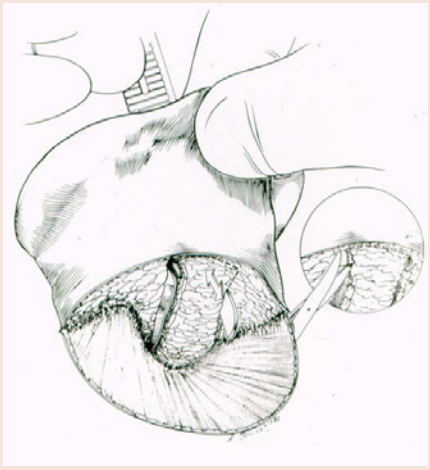

Figure 17: Korner flap is released by cutting superior and inferior attachments to the concha with a pair of curved Stevens scissors.

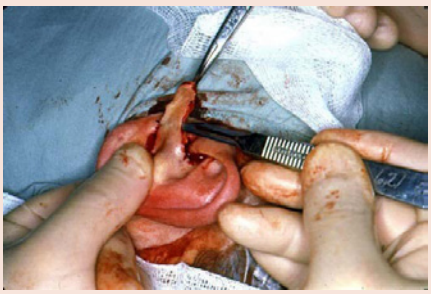

Figure 18: Korner broad-based pedicle flap.

If it is known that no cholesteatoma remains, the inferiorly based muscle pedicle flap is placed in the mastoid cavity to help reduce cavity size.

Note that it is the author's technique to usually obliterate only the inferior aspect of the cavity. Cholesteatoma must be completely removed, and, in most cases, any squamous epithelium left unknowingly is located in the upper portion of the cavity, such as near the sinodural angle and tegmen mastoidii. Because the inferior aspect of the cavity is also the area subjected to postoperative debris

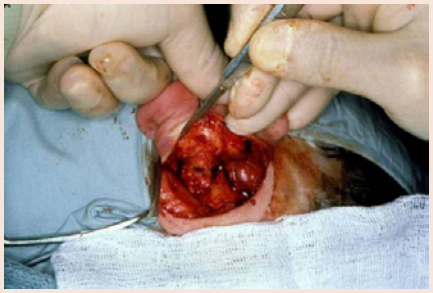

Figure 19: Remove a generous crescent of the conchal cartilage with a no. 15 blade while pushing the index finger posteriorly in the external auditory meatus.

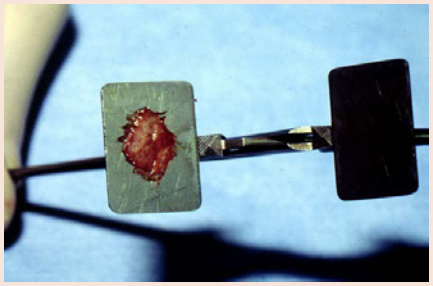

Figure 20: Temporalis fascia is placed in a cruncher.

accumulation, which can lead to infection, the cavity size should be reduced with an inferiorly based pedicle flap. This is not to be confused with "blindly" obliterating the whole cavity, thus introducing the strong possibility of burying disease.

The temporalis fascia is placed in a cruncher (Figure 20), spread thin, and given just one click (too many clicks destroy the tissue). When this is dried, it looks almost like a tympanic membrane.

Again the goal of this procedure is to make the shape of the cavity and the ear canal more of a cylindrical shape instead of an hourglass, thereby minimizing the cavity.

Statistics and results

Using this method, the success rate for type I tympanoplasty, defined as an air-bone gap of less than 10 dB, has been 95%. For type III tympanoplasty the success rate, defined as less than 25 dB air-bone gap, has been 88%. The type IV tympanoplasty has had a success rate of 72%, success being defined as an air-bone gap of less than 30 dB. Taking 227 cases with preoperative cholesteatoma, only 13 had a recurrence postoperatively; 94.3% of the cases had no recurrence of cholesteatoma. Of 88 patients who had type I tympanoplasty, none had loss of bone conduction thresholds. Of 340 patients who had type III tympanoplasty and 72 patients who had type IV tympanoplasty, only 1.5% and 5.6%, respectively, had any loss of bone conduction thresholds.

Common errors

The common mistake among residents is to attempt to locate the antrum too posteriorly and too inferiorly, thereby looking for a hole that is not there, damaging the horizontal canal, the facial nerve, or the sigmoid sinus in the process. Surgeons should examine many temporal bones to be sure of the exact location of the antrum which is usually a little more superior and anterior than the residents think. At the same time, one does not want to go too superiorly, getting into the dura instead Figure 21).

Treatment of CSF leak

If the dura is exposed when drilling during mastoidectomy and a cerebrospinal fluid (CSF) leak does not result, this is not cause for alarm. The patient should be placed (1) on one bolus of antibiotic (Kefzol) and (2) on antibiotics orally postoperatively for 1 week. If, however, the patient has a CSF leak, then the patient should remain in the hospital for at least 24 to 48 hours on intravenous antibiotics. The CSF leak should be repaired with fascia and muscle grafts. Besides using a free temporalis fascia graft, an alternative is to use the pedicle temporalis fascia graft carrying with its own blood supply as described previously (Figures 6-8).

Other complications

If a fistula is made in the semicircular canal, make sure there are no ototoxic drugs such as Cortisporin in the operative site. Furthermore, suction should not be maintained on the fistula. Instead, Gelfoam and saline, kept soaking, should cover the fistula while the operation is carefully completed. At the end of the operation, a fascia graft is used to repair the fistula.

In sigmoid sinus laceration, again, there is no need to worry. If tightly packed with surgicel, the bleeding can always be controlled.

Medial vs. Lateral Graft Placement

Medial and lateral graft placement techniques have their pros and cons. The author prefers lateral placement technique for the specific instance of an anterior perforation in which there is no remnant of the tympanic membrane anteriorly. The lateral graft is easier to perform than the medial graft, and its placement removes the possibility of retracting into the eustachian tube area in the protympanum. The disadvantage of the lateral technique is that any buried squamous debris can develop into cholesteatoma. Furthermore, any lateral

Figure 21: Simple mastoidectomy cavity showing horizontal canal and short process of the incus.

migration that might occur, as well as blunting of the anterior sulcus, can lead to poor ossicular contact.

Thus in the lateral placement technique it is necessary to (1) meticulously de-epithelize the lateral surface of the tympanic membrane, the edges of the perforation, and the medial surfaces of the remnant adjacent to the perforation, and (2) to carefully and snugly pack anteriorly the lateral graft in position, it is necessary to eliminate any excessive anterior canal bony bulges.

Suggested Reading

Lee, KJ, editor: Essential Otolaryngology. 10th edition, New York City, McGraw-Hill, 2012.

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