Chapter 1
Tympanoplasty
General Considerations

1. Definitions

The surgical reconstruction of the tympano-ossicular system (tympanoplasty) includes: canalplasty, myringoplasty, and ossiculoplasty.

Myringoplasty is a technique for reconstructing a vibrating tympanic membrane. The widening of the external auditory canal (canalplasty) is an integral part of myringoplasty. It should be carried out for the grafting of all anterior perforations of the tympanic membrane because it gives the necessary surgical access for their adequate repair. Canalplasty also facilitates healing, cleansing, and second-stage ossiculoplasty. Different types of ossiculoplasty are necessary to restore the sound transmission from the drum to the inner ear.

2. Aims of Tympanoplasty

- Eradication of disease
- Restoration of tympanic aeration
- Reconstruction of a sound-transformer mechanism
- Creation of a dry, self-cleansing cavity

3. Preoperative Care

3.1 Preoperative Investigations

Tubal function. The function of the eustachian tube is assumed to be normal when the Valsalva or Toynbee maneuver is positive.

Tympanometry is performed if the above-mentioned test results are negative.

Knowledge of eustachian tube function is important for proper surgical planning and to assess the chance of a possible hearing improvement. Negative tubal tests, however, are not an absolute contraindication for tympanoplasty. Normal ventilation may indeed be restored in spite of a negative tubal test by surgical excision of scar tissue occluding the tympanic ostium of the eustachian tube. Good aeration of the opposite ear may serve as an indicator of good tubal function.

Temporary closure of perforation. Applying a disk of wet Gelfilm over the remaining drum permits temporary closure of a perforation. Resulting changes in hearing permit assessment of the condition of the ossicular chain and/or the oval and round windows.

Fistula test. The fistula test should always be performed when a patient complains of
vertigo or in the presence of a cholesteatoma. It is the unexpected fistula that leads to deafness at surgery. Be certain to maintain a good seal when performing the fistula test to avoid a caloric response to cold air.

### 3.2 Rules for Preoperative Treatment

The operating microscope or equivalent magnification as well as aspirating tubes is an essential prerequisite for proper preoperative evaluation and treatment. The aim is to operate, if possible, on a dry, well-ventilated ear.

1. Clean the external canal using aspiration to remove fluid, and 3% hydrogen peroxide (HiOii) to mollify dry secretion.
2. Apply antibiotic ear drops or ointment on a strip of 0.5-cm ribbon gauze. The gauze should not be impregnated with too much ointment. The purpose of introducing gauze into the external auditory canal is:
   1) to avoid free diffusion of ototoxic drugs into the middle ear, and
   2) to absorb secretion from the external canal.
   The strip of gauze should be changed frequently until it remains dry.

- Avoid:
  1) systemic antibiotics, if there are no signs of general infection,
  2) the use of free ear drops since in the presence of a perforated drum, a sensorineural deafness may be induced.

### 3.3 Antibiotic Treatment

**Dry ears.** Routine perioperative i.v. antibiotic treatment, Bactrim* (trimethoprim sulfamethoxazole) or Augmentin** (amoxicillin and clavulanic acid) is given for myringoplasty, tympanoplasty with extensive bone work (mastoidectomy, epitympanectomy, posterior tympanotomy, modified radical operation, and reconstruction of an open cavity).

No antibiotics are given for reconstruction of the ossicular chain when the drum is intact (particularly in second-stage operations) as well as for stapedectomy and stapedotomy.

**Draining ears.** If the preoperative treatment did not succeed in drying the ear, a bacteriologic investigation of the persisting secretion is performed only when the secretion is purulent.

A predominantly clear mucous secretion is related to hyperplastic changes of the mucosa of the tympanic cavity and does not require bacteriologic investigation. Gram-negative microbes such as *Pseudomonas pyocyanea* and *Proteus mirabilis*, as well as fungi, are commonly found in most middle ear secretions because of a superinfection originating from the external canal. If the secretion is not frankly purulent, these microbes do not need specific treatment.

### 3.4 Preoperative Preparation

The hair is shaved above and behind the ear, (2 cm for tympanoplasty and mastoidectomy). No hair is removed for the endaural approach (stapedotomy, stapedectomy, or second-stage ossicular reconstruction).

The external canal is cleaned by the surgeon a day before. When a perforation is present, the canal is filled with sterile gauze during the surgical preparation to avoid injury to the middle ear by the disinfecting agent. The skin of the operating field and the pinna are cleaned with soap and water and a disinfection solution (Braunol 2000*). No effort is made to disinfect the external canal because we do not believe that sterilization is possible.

* Supplier Hoffmann-La Roche A.G., Basel, Switzerland
** Supplier Beecham

* Polyvinylpyrrolidon Jodine Compound (Braun Medical AG), Germany
4. Postoperative Care

The operating microscope or equivalent magnification, as well as aspirating tubes, speculum, and forceps are essential prerequisites for proper postoperative treatment.

4.1 Myringoplasty, Tympanoplasty

- If packing remains dry: nothing for 8-10 days.
- If packing becomes wet: aspirate excess fluid daily from the packing for 6-8 days. The packing is removed under the microscope after 6-10 days. Gelfoam pledgets filling the canal are removed by gentle aspiration. Gelfoam pledgets over the fascia are left in place for another week. Strips of gauze slightly impregnated with antibiotic ointment (Terracortril, Pfizer International, New York) are placed in the canal during this time. Later on, drying strips of gauze impregnated with antibiotic solution (Otosporin, Wellcome Foundation Ltd., London) are used.
- Transmastoid drain, see page 106.

4.2 Open Cavity (Radical Mastoido-Epitympanectomy with Tympanoplasty [Bad. MET])

- Aspirate excess fluid from the packing daily for 6-8 days.
- Remove strips of gauze impregnated with ointment in 3-4 steps at 2-3-day intervals.
- Begin to suction away gelfoam filling the cavity, after 2-3 weeks.
- Use strips of gauze impregnated with ointment until granulation tissue has covered the bare bone. Drying gauze with antibiotic solution is used thereafter.
- Do not forget that in the presence of long-standing preoperative infections, an open cavity may need 1.5-2 months to epithelize completely.
- Do not forget that the postoperative treatment is as important as the operation itself.

5. Anesthesia

5.1 Local Anesthesia

Indication

Local anesthesia (LA) is used whenever no extensive bone work is needed in combination with an endaural approach (myringoplasty, second-stage ossicular chain reconstruction, stapes surgery).

Premedication

For adults of average weight (70 kg), 10 mg Valium (diazepam) or, if anxiolytic is required, Dormicum (midazolam) per os 45 minutes before surgery.

Injection

20 ml 1% lidocaine with 2 drops of 1:1,000 epinephrine (final concentration 1:200000 epinephrine); 5-10 ml thereof are injected as demonstrated in Fig. 1.

The advantage of this method of local anesthesia is that it causes minimal pain to the patients. Infiltration of the soft tissues surrounding the auricle may induce a transient homolateral facial palsy. A study carried out by J. M. Lancer* has shown that no adverse effects were observed either as a consequence of local anesthesia itself, or of the transient fa-

Initial site of injection for local anesthesia

Initially the needle is inserted in the postauricular sulcus and advanced anteroinferiorly. Five ml LA are administered by continuous infiltration during slow withdrawal to block the great auricular nerve. The needle is redirected through the same injection site and advanced anterosuperiorly. An additional 5 ml is given with the aim of blocking the auricular branches of the auriculotemporal nerve.

Canal injections for local anesthesia

Prior to the administration of LA, each patient is warned that there may be some pain or discomfort and that there is the possibility of transient facial weakness for 1-2 hours following injection. The postauricular injection reduces the initial pain, gives an excellent "adequacy of anesthesia" score, and abolishes the unpleasant sensation caused by manipulation of the chorda tympani during surgery.

5.2 General Anesthesia

Premedication

For adults of average weight (70 kg), 10 mg Valium (sedative) or Dolantin (meperidine)-atropine i.m. 30 minutes before surgery.

Induction

Thiopental, etomidate or propofol and fentanyl (0.5 mg). Muscle relaxation with Celocurin. Intubation.

Continuation

Atracurium or Pavulon for muscle relaxation. Artificial respiration with oxygen-nitrous oxide. Repeated injections of fentanyl or alfentanil. Regulation of depth of narcosis with enflurane or isoflurane.

The combination of Valium and fentanyl for general anesthesia avoids

1) the annoying capillary vasodilation produced by most other anesthetics, and
2) sensitization of the cardiac conductive system to epinephrine (as observed, e.g. with Fluothane).
6. Facial Nerve Monitoring

Monitoring facial nerve function using EMG needles placed in the muscles of the face is essential in surgical procedures that carry a risk for the facial nerve (e.g. closed and open mastoido-epitympanectomy, revision surgery after radical mastoidectomy, tympanoplasty in atretic ears). In the past 6 years, we have used the Nicolet system and later on the Xomed NIM-2 system (Fig. 2). Next to the anatomical identification of the position of the facial nerve, the great advantage of monitoring is that constant information on the status of the nerve can be obtained by listening to the spontaneous activity of the facial muscles. There are many occasions in which manipulation carried out away from the facial nerve may lead to a response of the facial muscles indicating that an exposed nerve has been touched inadvertently by the shaft of an instrument, or that granulation thought to be independent is indeed attached to the nerve. Monitoring is utilized in our department for teaching purposes when residents perform open or closed cavity mastoidectomy. Systematic use of facial nerve monitoring in the training of otologic surgeons should reduce and hopefully eliminate the "inevitable" reported rate of 1 - 3% facial nerve lesions involved in otologic training.

![Intraoperative Facial Nerve Monitoring](image)

**Fig. 2**

**Intraoperative facial nerve monitoring.**

Position of Electrodes for two channel intraoperative EMG recording with the Xomed-Nerve Integrity monitor (NIM-2). An insulated micro-raspatory (left and right) is used to assess the position of the facial nerve by electrical stimulation.

7. Instrumentation

(See separate chapter at the end of the book)
8. Rules and Hints

- Communicate with the anesthetist concerning the use of muscle relaxants. Be sure that this information is shared with anesthesia personnel, who may enter the case after it is underway.
- When in doubt about nerve monitor function, it is best to test the nerve at a known location.
- Be sure that the assistants and nurses understand the operation of the monitor so that technical problems are recognized and inadvertent changes are not made to instrument settings.
- Injection of local anesthetics may interfere with the function of the monitor.
- Stimulator probe function can be tested by observing the contractions of an exposed muscle.
- Extreme levels of sound may be generated by aspiration of the ear. The patient should be warned of this prior to beginning. Caution should be used and excessive suctioning near the drum should be avoided because of the risk of acoustic trauma to the inner ear.
- Early in the postoperative period, caution should be used when cleaning the ear to avoid disturbing the graft or the canal flaps.
- Patients should be available for 1 week following stapes surgery, ossiculoplasty, and minor procedures done under local anesthesia. This is necessary for cleaning and maintaining the ear, as well as for reassurance if pain, dizziness, or other symptoms appear.
- After closed or open cavity mastoidoepitympanectomy, patients should be available for 10-14 days, until they can change the ribbon gauze in the canal themselves.
- Flying after stapes surgery and tympanoplasty (ossiculoplasty and myringoplasty) is best avoided for 3 weeks.
- Strict avoidance of water in the ear should be stressed to all patients.
- Patients should be instructed preoperatively of the permanent limitations after ossiculoplasty and stapes surgery (scuba diving, avoidance of intensive manipulations of the external canal with Q-tips, fingers, etc.)