Chronic Suppurative Otitis Media: Current Concepts and Management

Prof. Dr. Santhosh Kumar Rajamani

Department of Otorhinolaryngology
MIMER Medical College, Talegaon Dhabade Pune MH

March 2, 2025

Outline

Definition and Epidemiology

- Chronic Suppurative Otitis Media (CSOM) is characterized by:
  - Chronic inflammation of the middle ear and mastoid cavity
  - Persistent or recurrent otorrhea
  - Tympanic membrane perforation
  - Conductive hearing loss
- Global burden:
  - Affects 65-330 million individuals worldwide
  - Prevalence of 1-46%, highest in developing countries
  - Accounts for 28,000 deaths annually due to complications

Classification

Tubotympanic (Safe) Type

- Central perforation
- Middle ear mucosa involvement
- Less aggressive disease
- Better prognosis
- Lower risk of complications

Atticoantral (Unsafe) Type

- Marginal/attic perforation
- Involves the attic, antrum, mastoid
- Cholesteatoma often present
- More destructive
- Higher risk of complications

Pathophysiology

- Multifactorial etiology:
  - Acute otitis media progression
  - Eustachian tube dysfunction
  - Upper respiratory tract infections
  - Poor socioeconomic conditions
  - Malnutrition
  - Inadequate healthcare access
- Middle ear mucosal changes:
  - Subepithelial inflammation
  - Goblet cell hyperplasia
  - Ciliary dysfunction
  - Mucin hypersecretion
  - Chronic biofilm formation

Microbiology

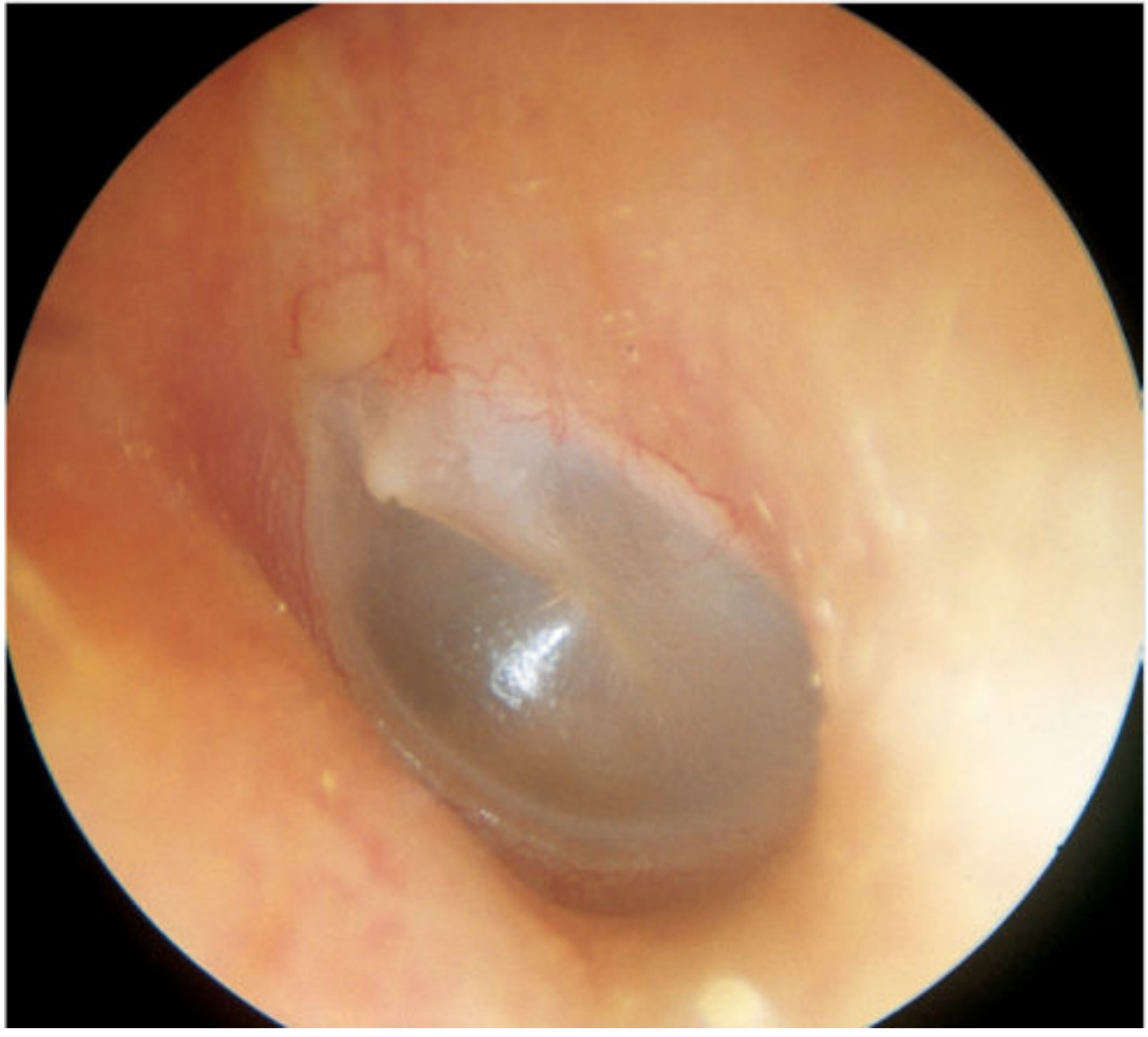
Common Pathogens:

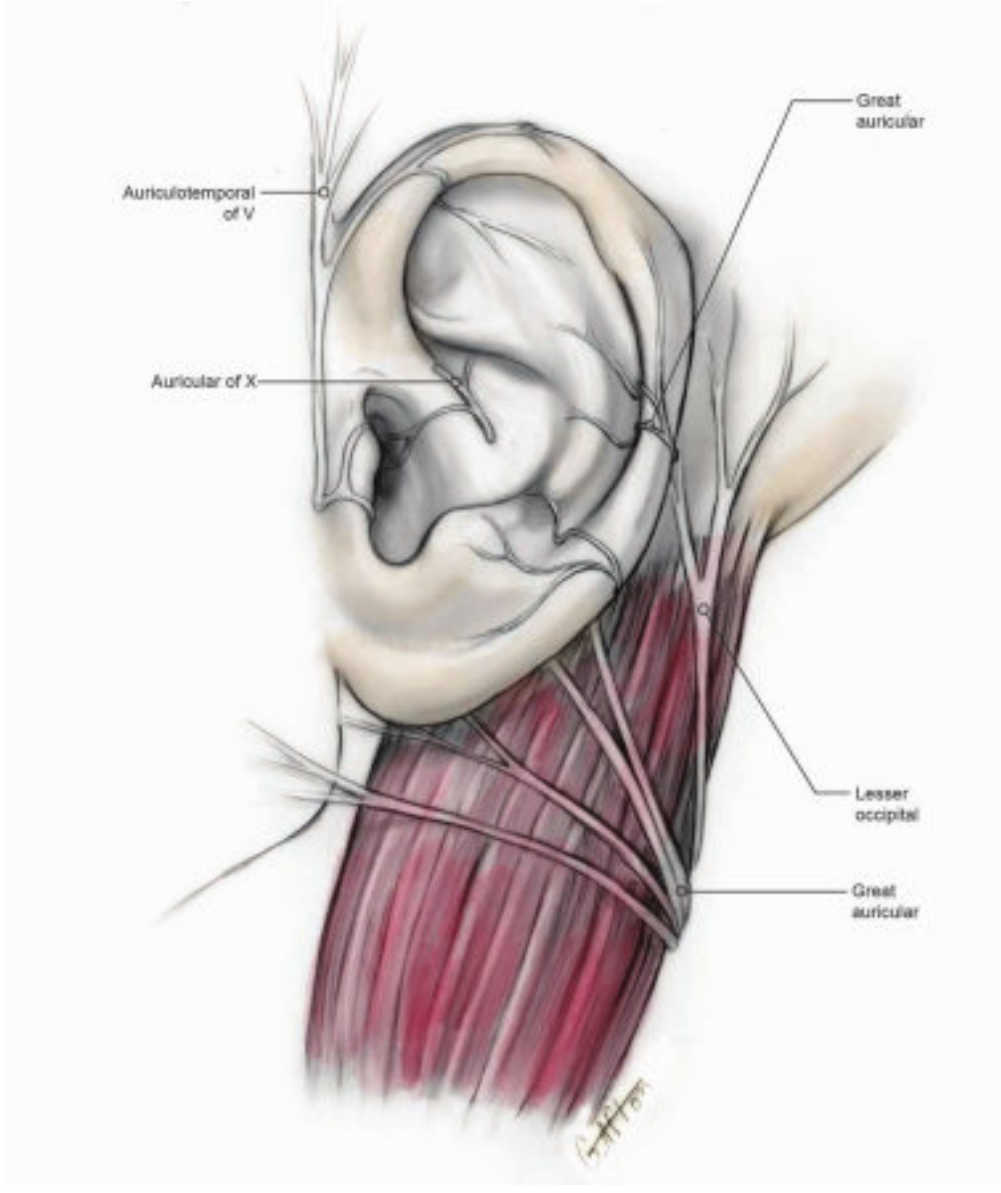
- *Pseudomonas aeruginosa* (40-60%)
- *Staphylococcus aureus* (15-30%)
- *Proteus* species (10-15%)
- *Klebsiella pneumoniae*
- *Escherichia coli*
- Anaerobes in cholesteatoma

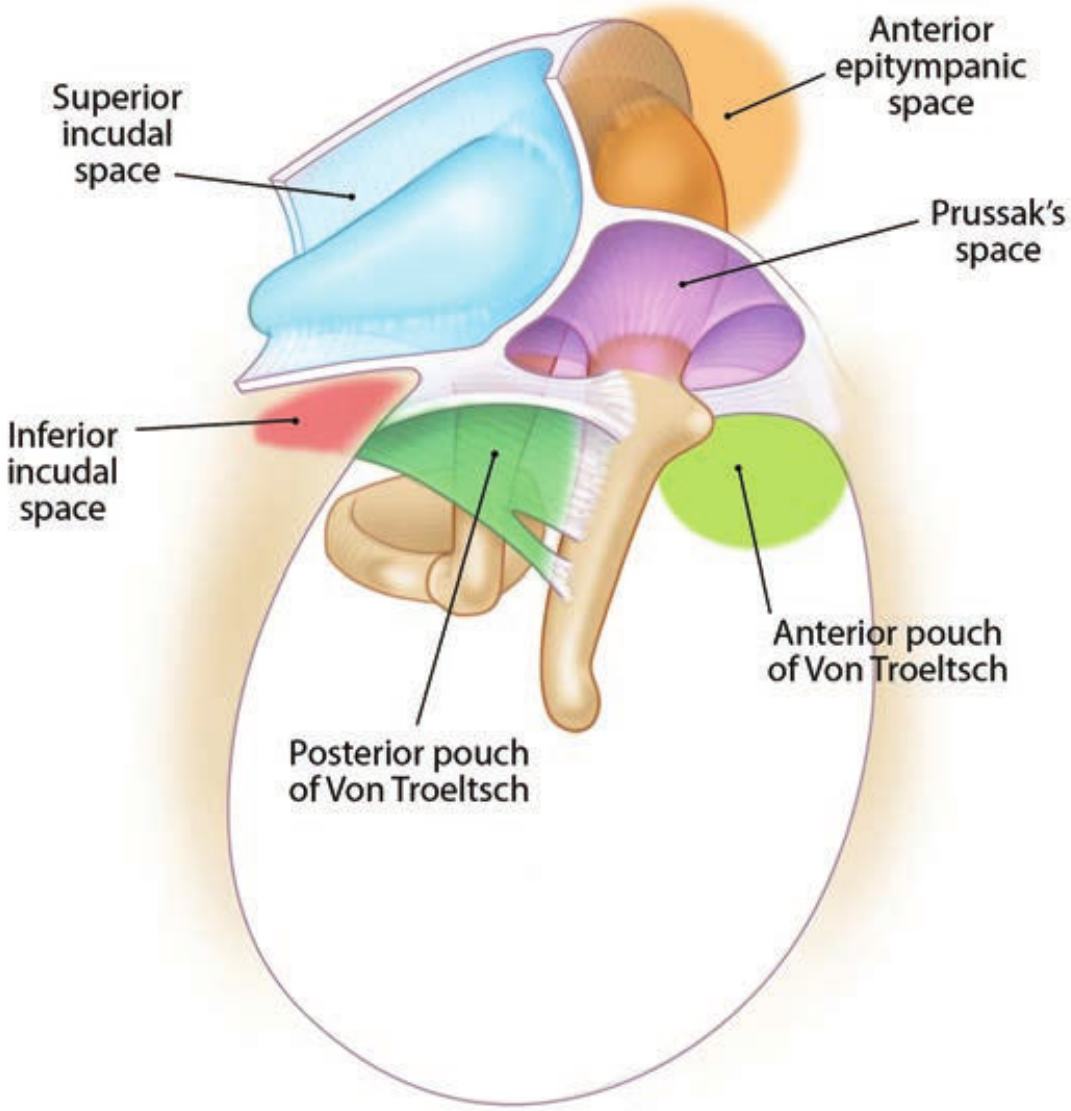
Biofilm Formation:

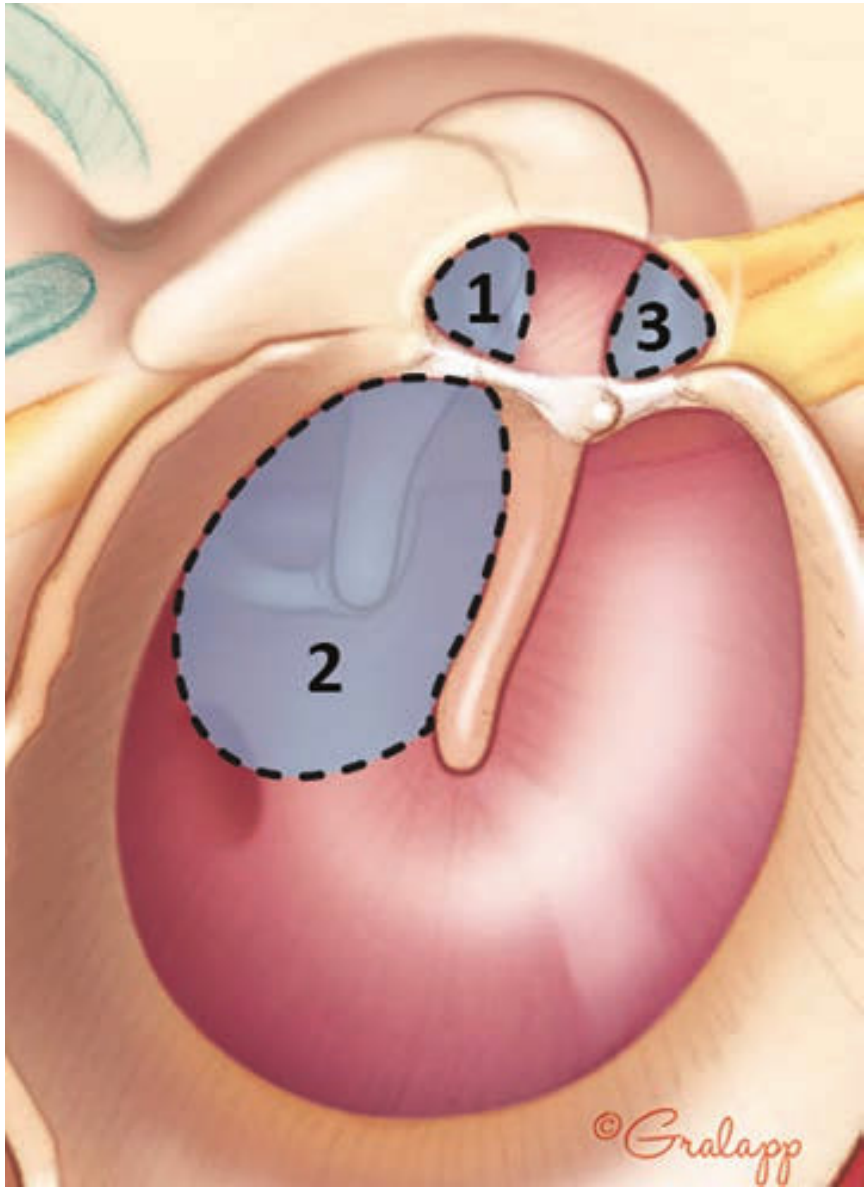
- Structured microbial communities
- Enhanced antibiotic resistance
- Reduced host immune clearance
- Chronic persistent infection
- Recurrent disease exacerbations

Fig. 2.1 Right ear. Normal tympanic membrane. 1, pars flaccida; 2, short process of the malleus; 3, handle of the malleus; 4, umbo; 5, supratubal recess; 6, tubal orifice; 7, hypotympanic air cells; 8, stapedius tendon; c, chorda tympani; I, incus; P, promontory; o, oval window; R, round window; T, tensor tympani; A, annulus.

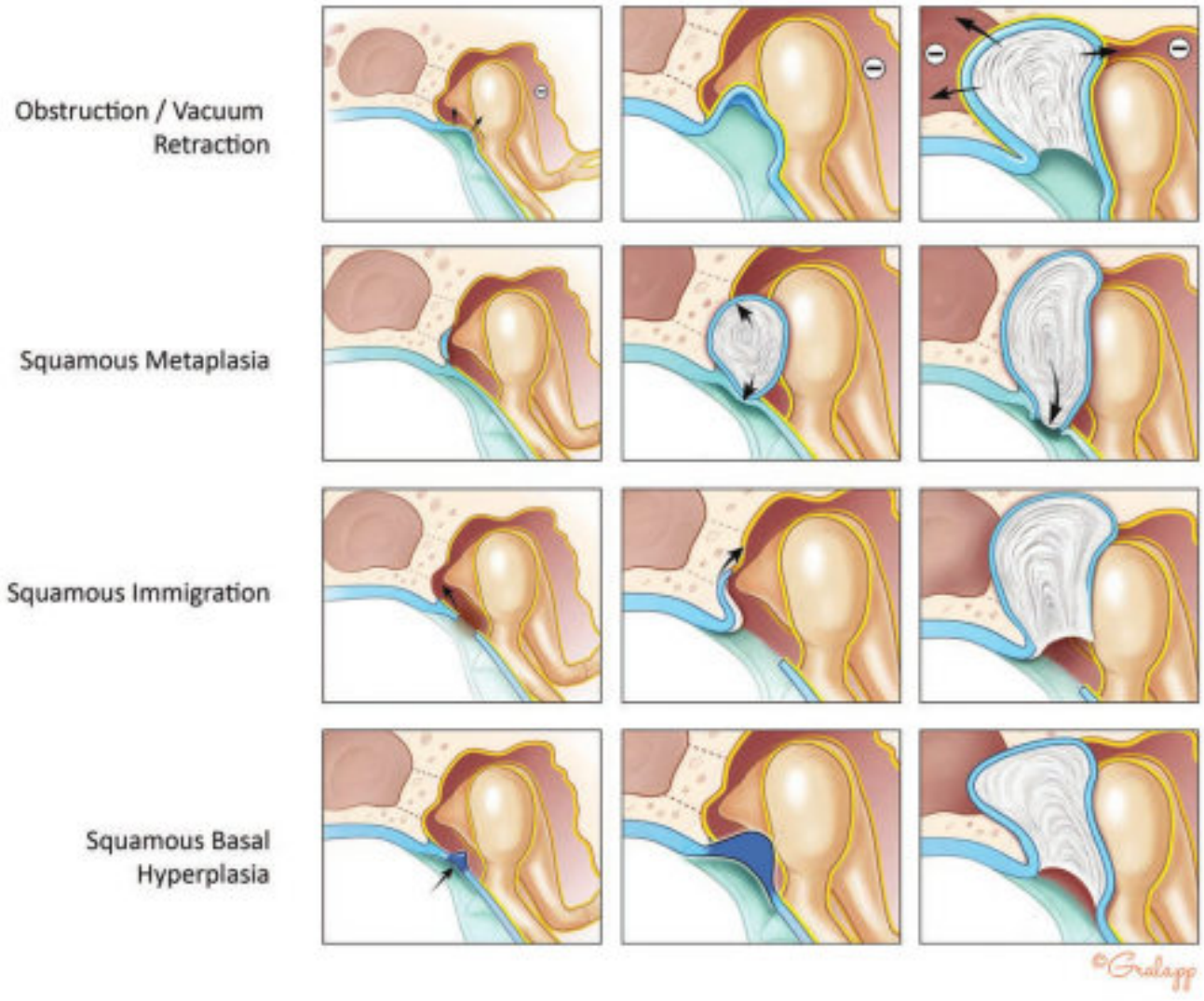



Great auricular
Auriculotemporal of V
Auriolular of X
Lesser occipital
Great auricular


Anterior epitympanic space
Superior incudal space
Prussak's space
Inferior incudal space
Anterior pouch of Von Troeltsch
Posterior pouch of Von Troeltsch

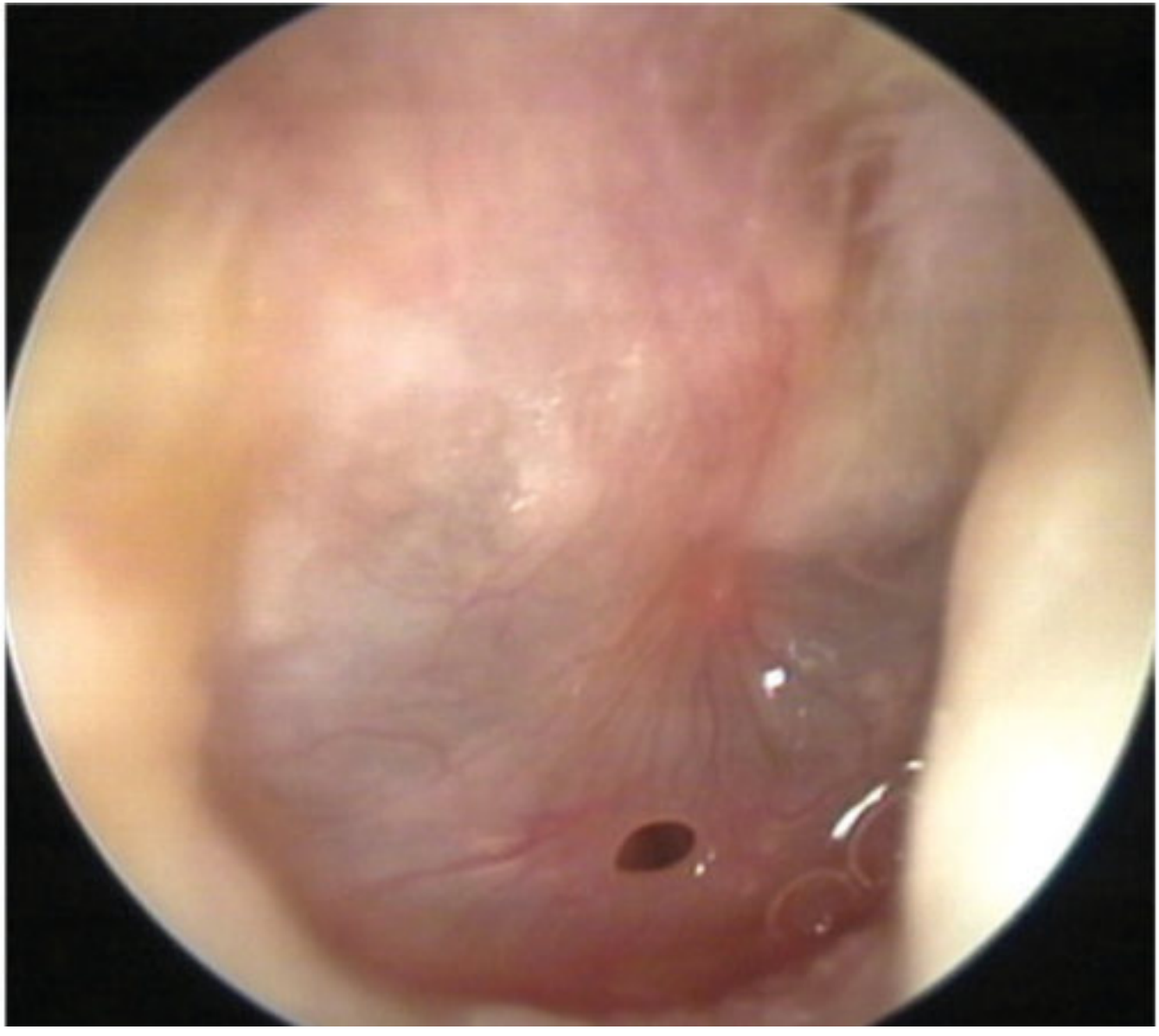

1
2
3
©Gralapp

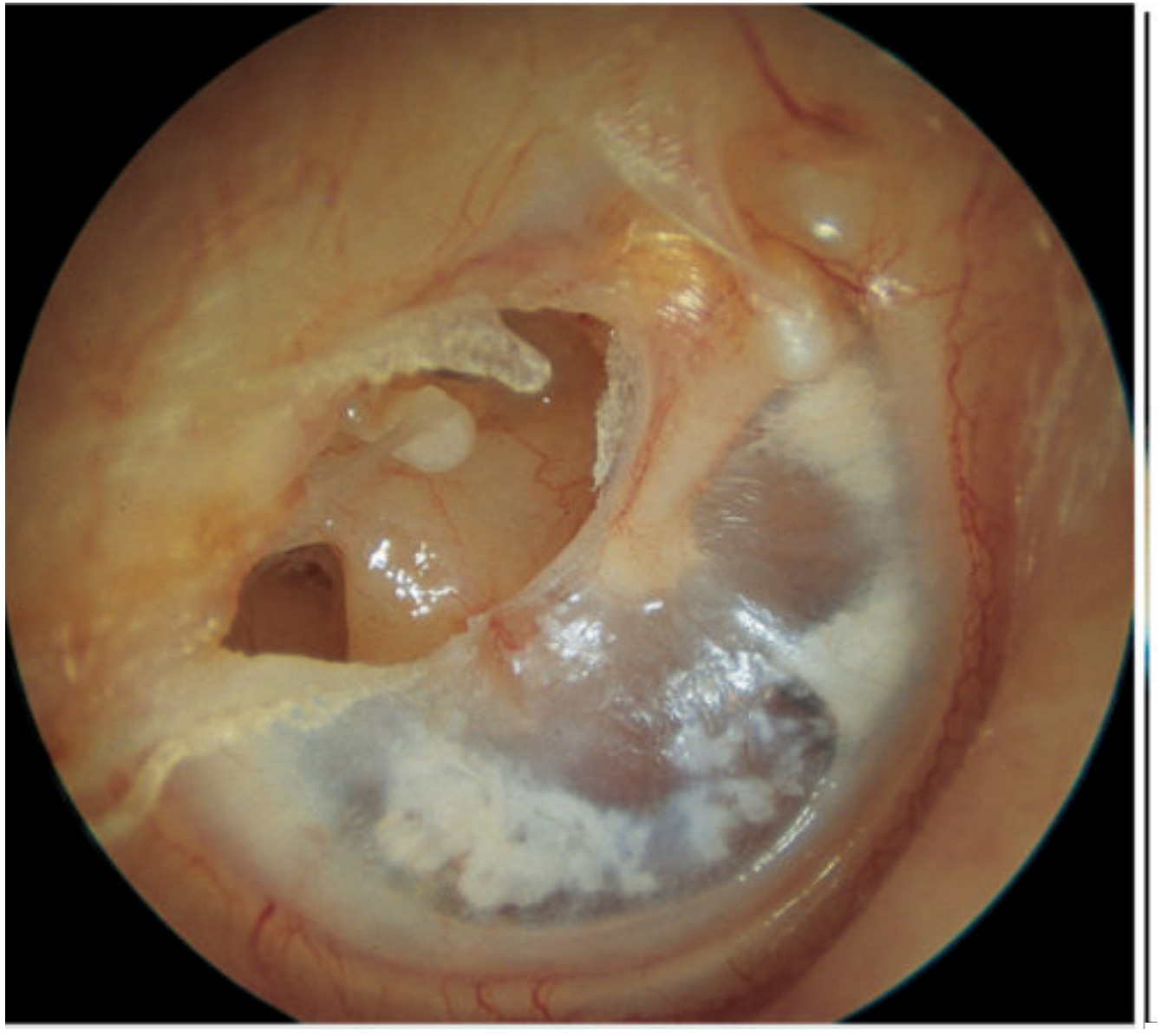
Existing Theories of Cholesteatoma Pathogenesis

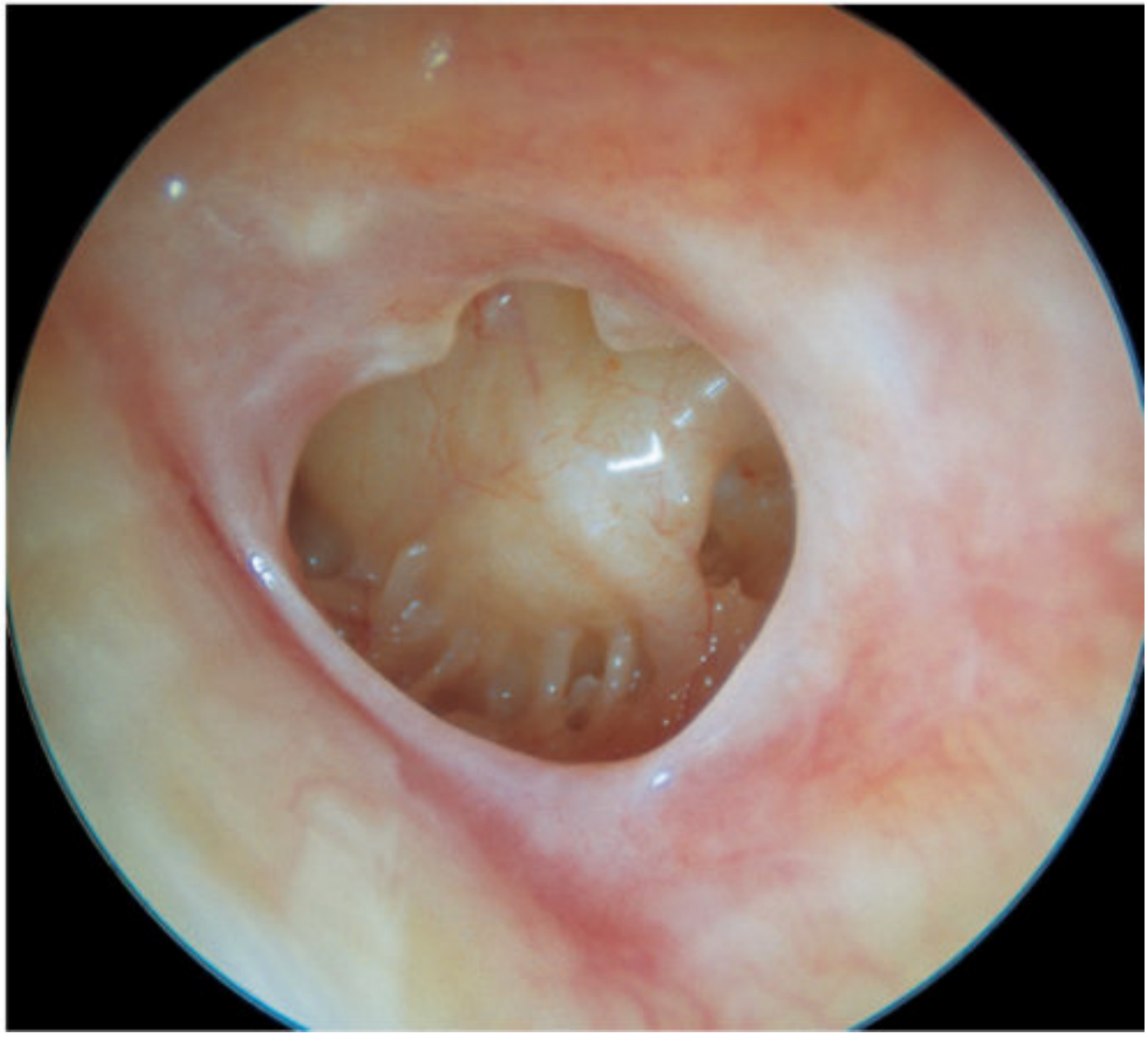


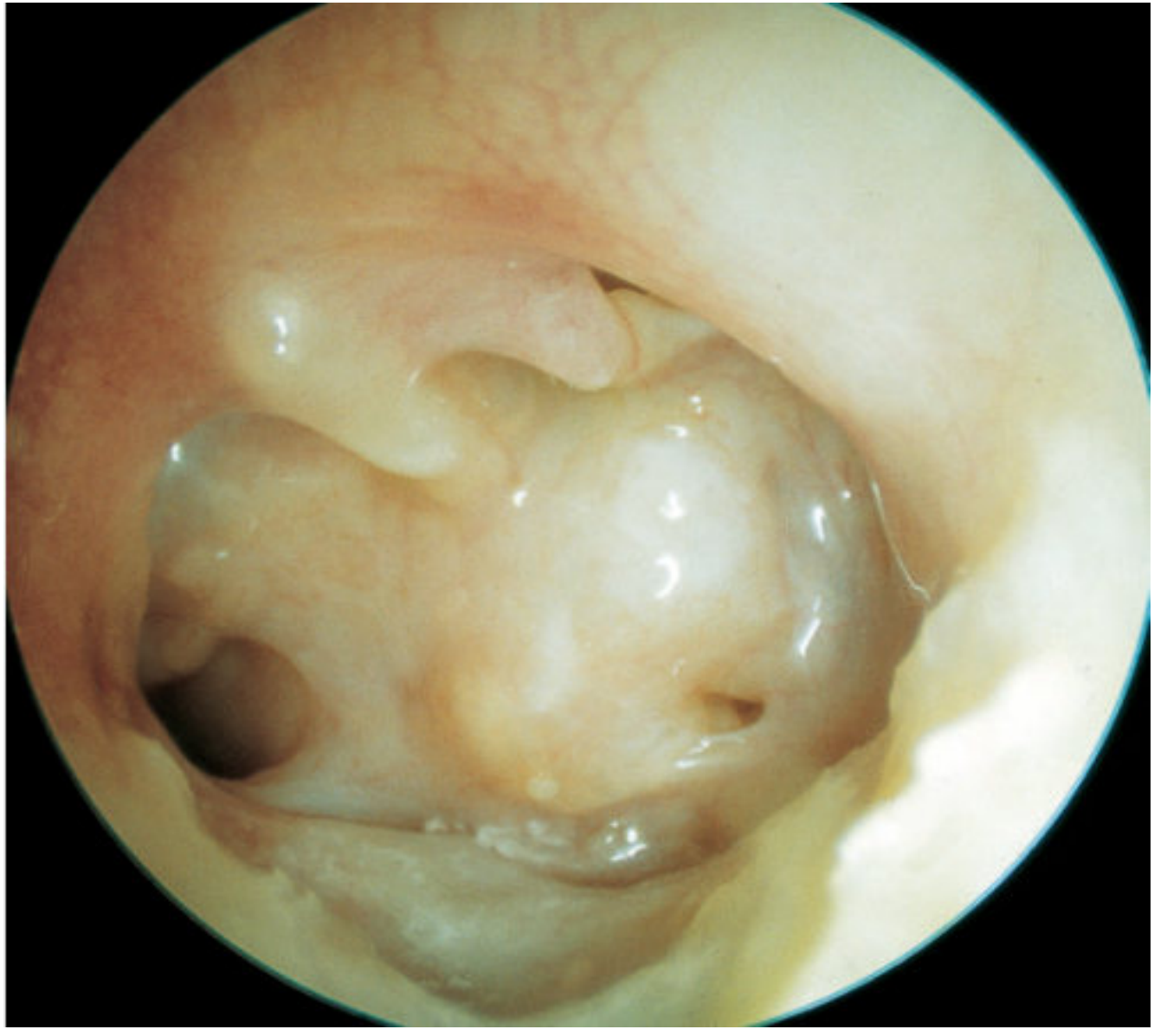
Clinical Features

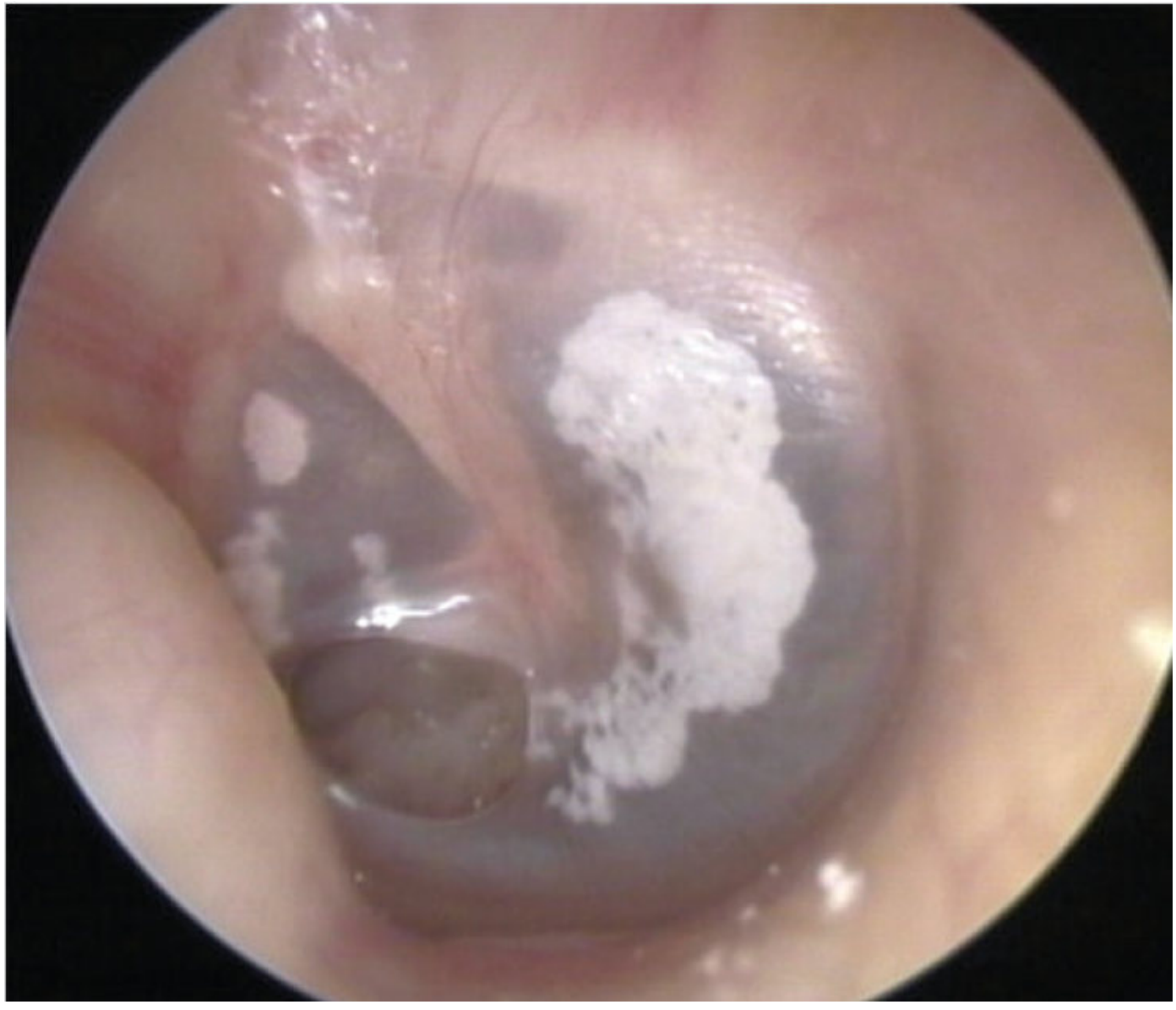
- Cardinal symptoms:
  - Persistent/recurrent ear discharge
  - Hearing impairment (conductive)
  - Ear fullness and discomfort
  - Tinnitus
  - Vertigo (in some cases)
- Otoscopic findings:
  - Tympanic membrane perforation
  - Mucosal edema and granulation
  - Polyps or cholesteatoma
  - Ossicular chain erosion
  - Variable discharge (mucoid, purulent, bloody)

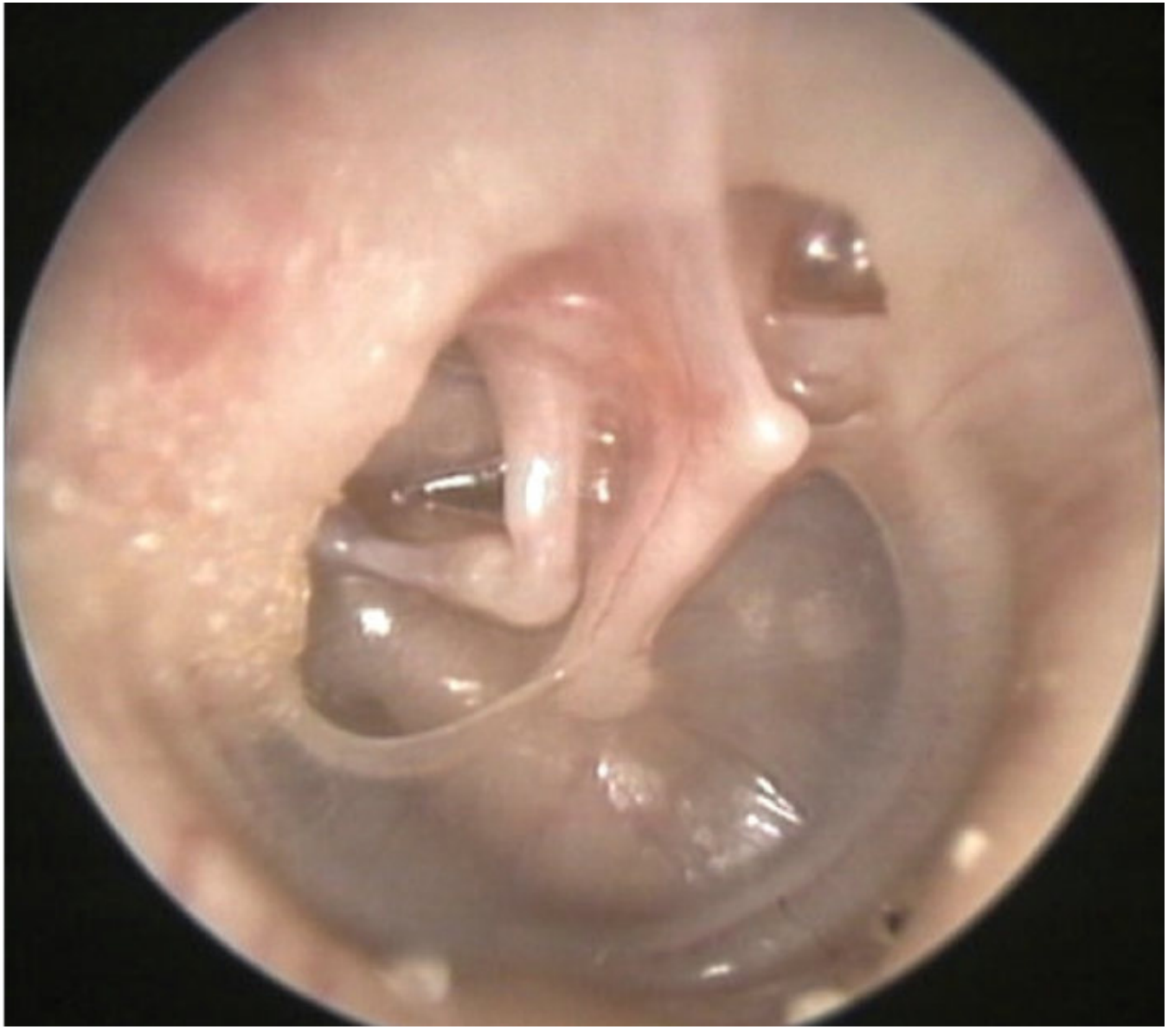


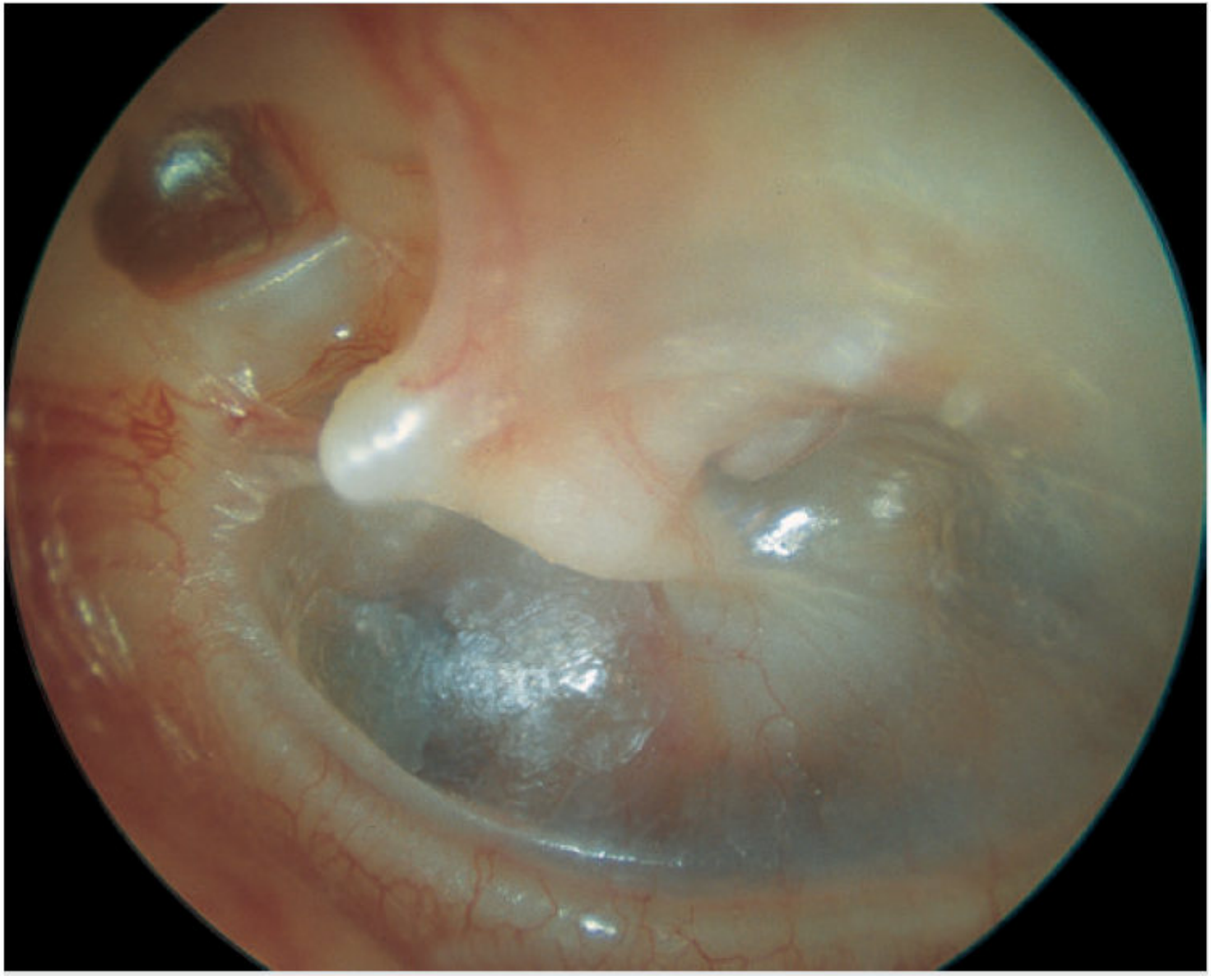


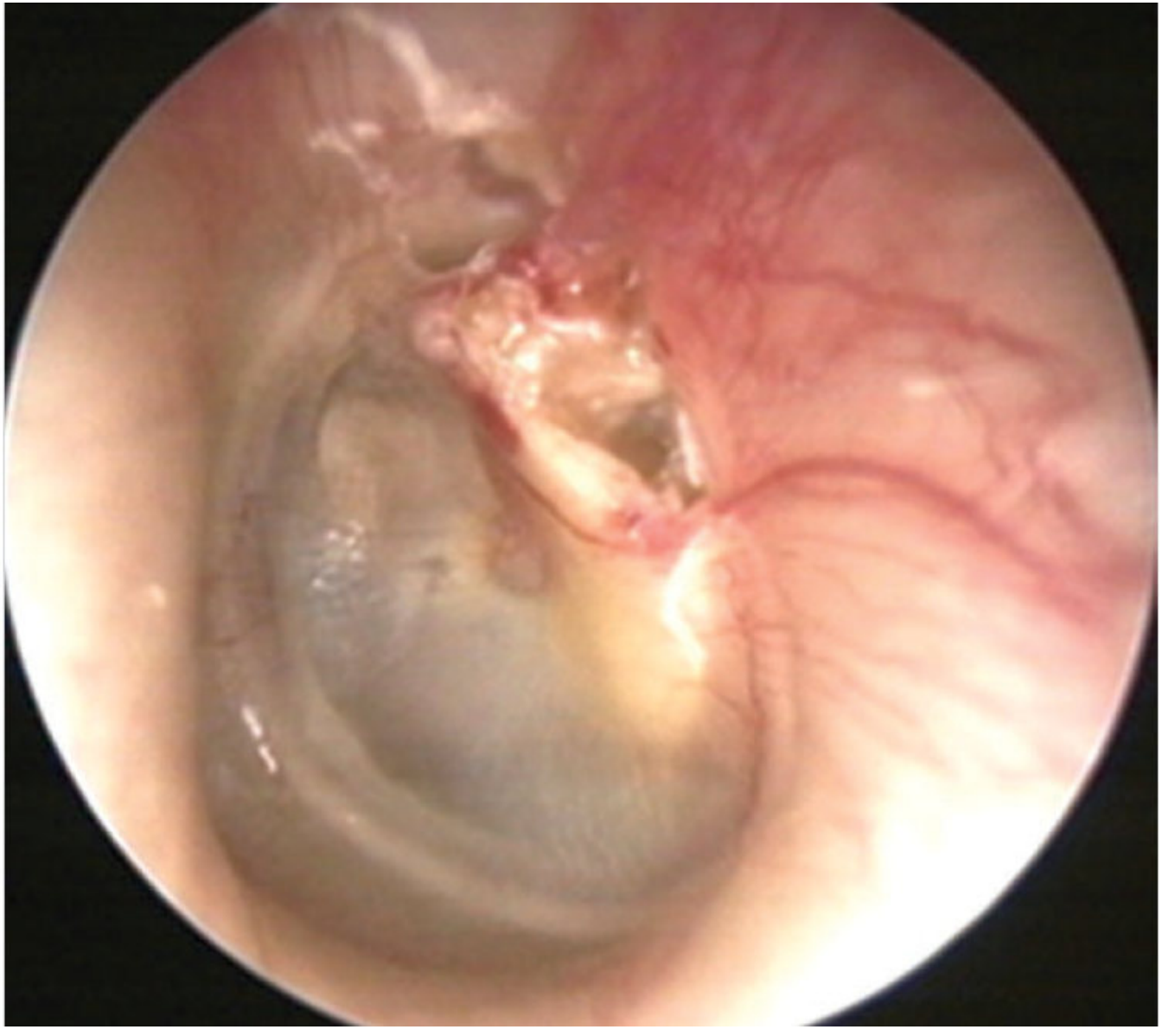


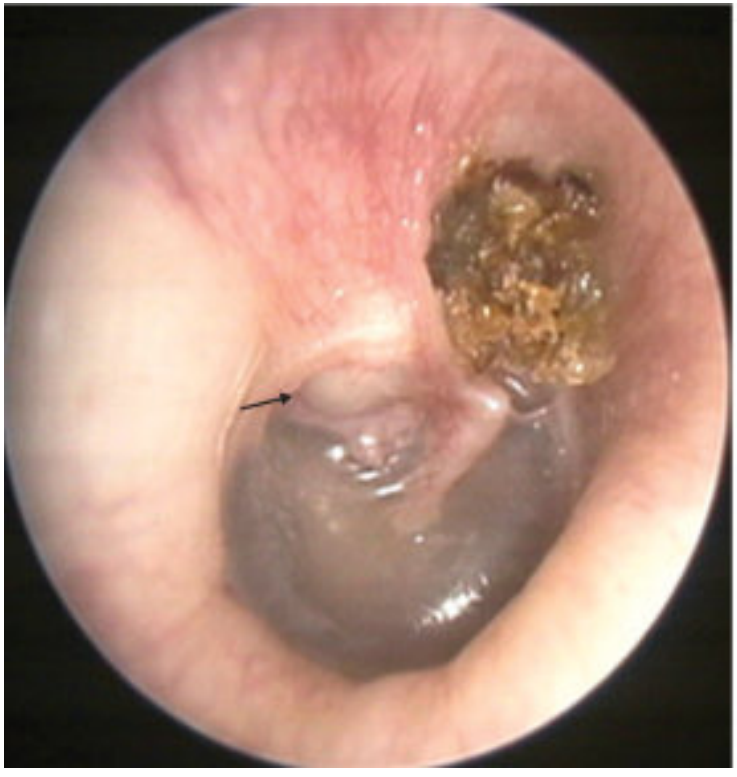


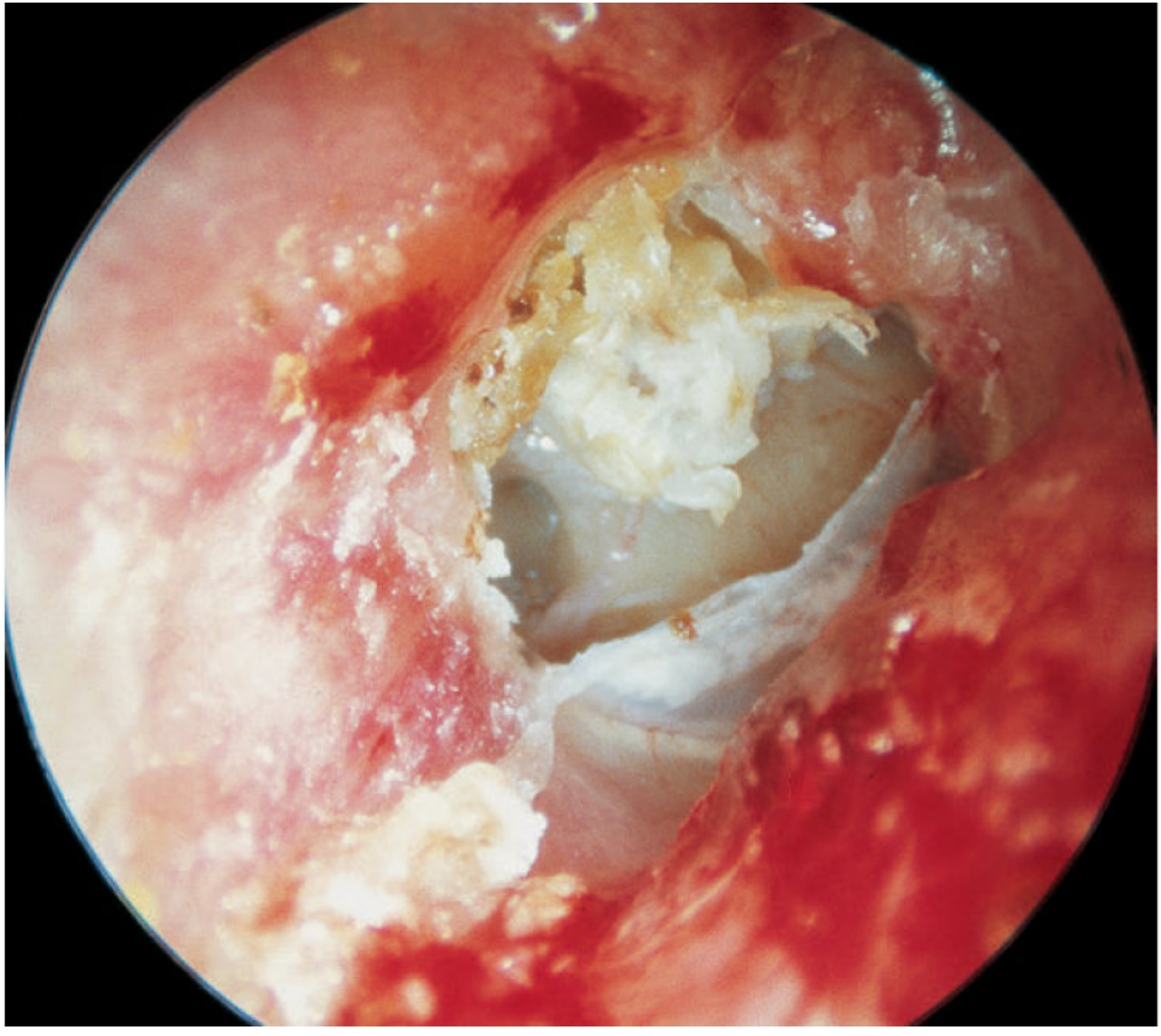












Complications

Extracranial:

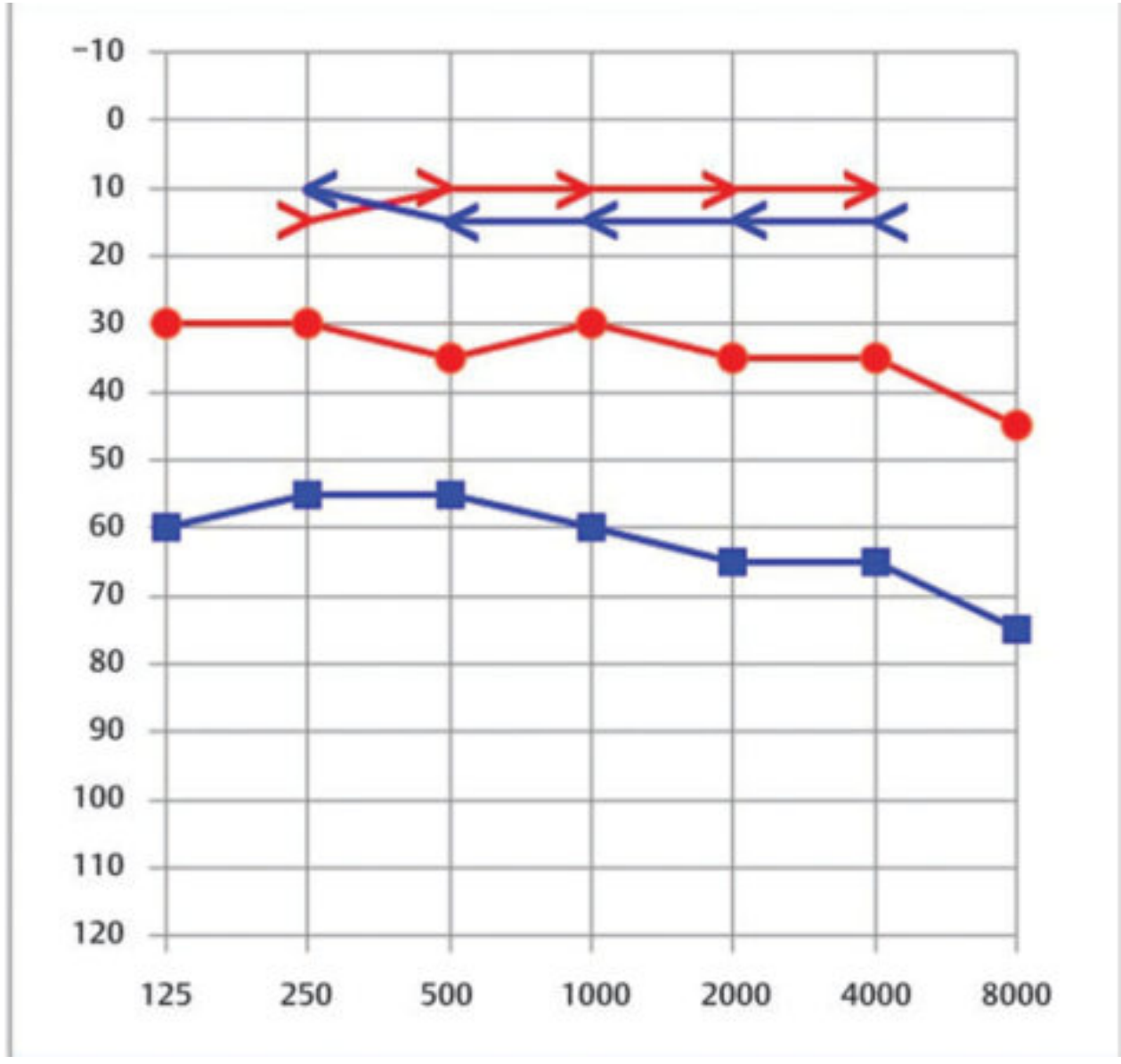
- Mastoiditis
- Facial nerve paralysis
- Labyrinthitis
- Petrositis
- Subperiosteal abscess
- Bezold's abscess

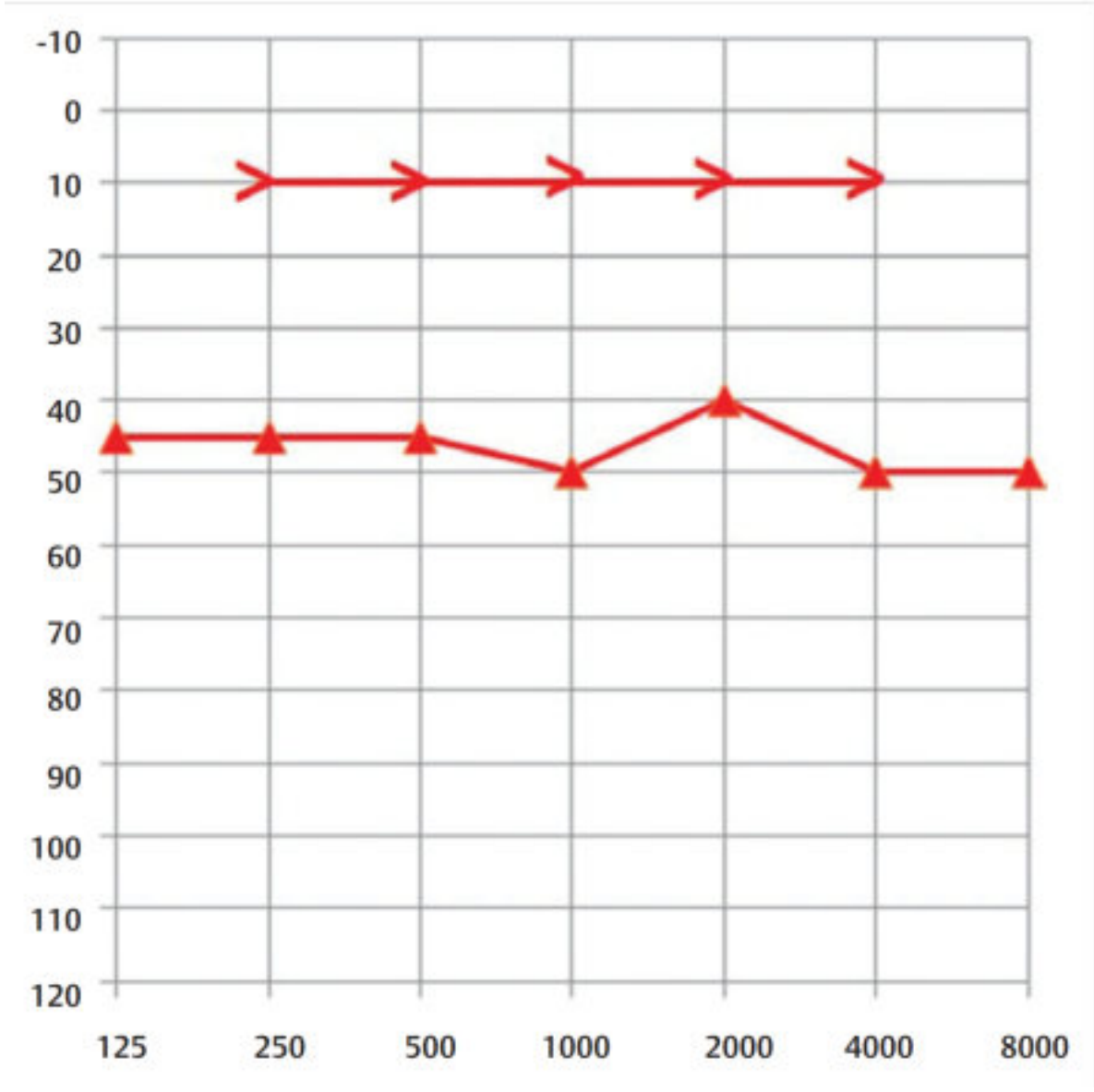
Intracranial:

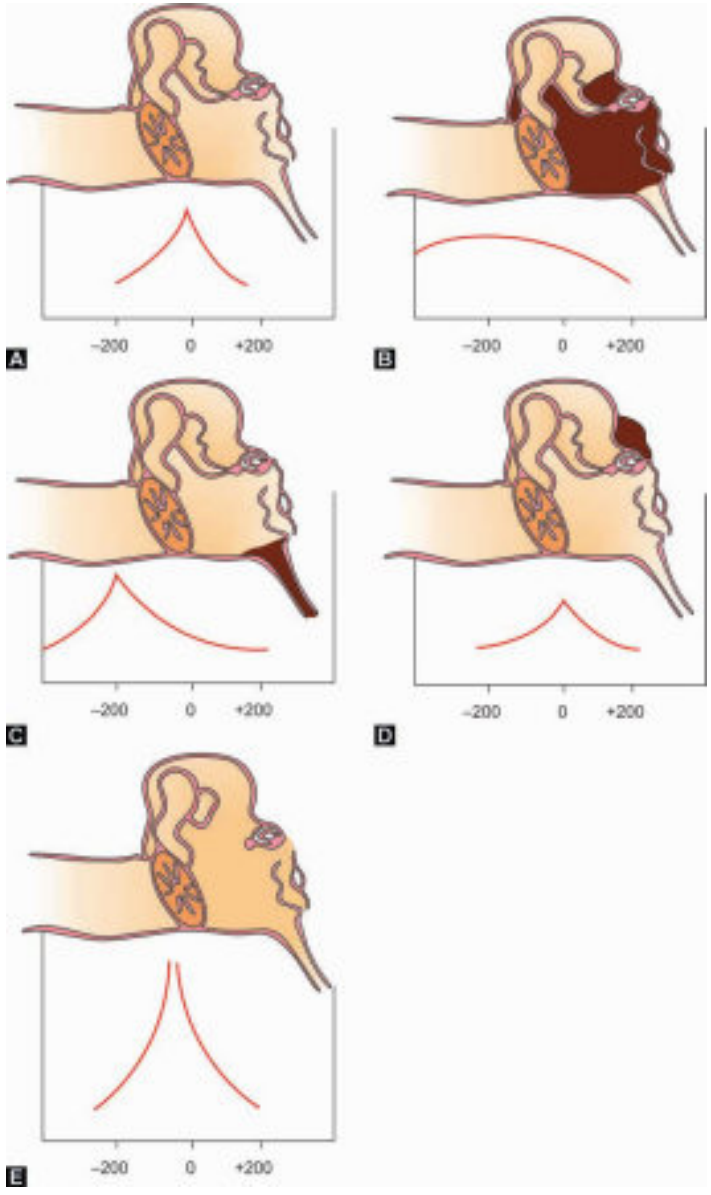
- Meningitis
- Brain abscess
- Lateral sinus thrombosis
- Otitic hydrocephalus
- Extradural abscess
- Subdural empyema

Diagnostic Approach

- Comprehensive history and otologic examination
- Otomicroscopy - gold standard for visualization
- Audiological assessment:
  - Pure tone audiometry
  - Speech audiometry
  - Tympanometry (when applicable)
- Microbiological studies:
  - Culture and sensitivity testing
  - Antibiotic resistance profiling
- Imaging studies for complications or surgical planning


-10
0
10
20
30
40
50
60
70
80
90
100
110
120
125
250
500
1000
2000
4000
8000


-10
0
10
20
30
40
50
60
70
80
90
100
110
120
125
250
500
1000
2000
4000
8000


A
−200
0
+200
B
−200
0
+200
C
−200
0
+200
D
−200
0
+200
E
−200
0
+200

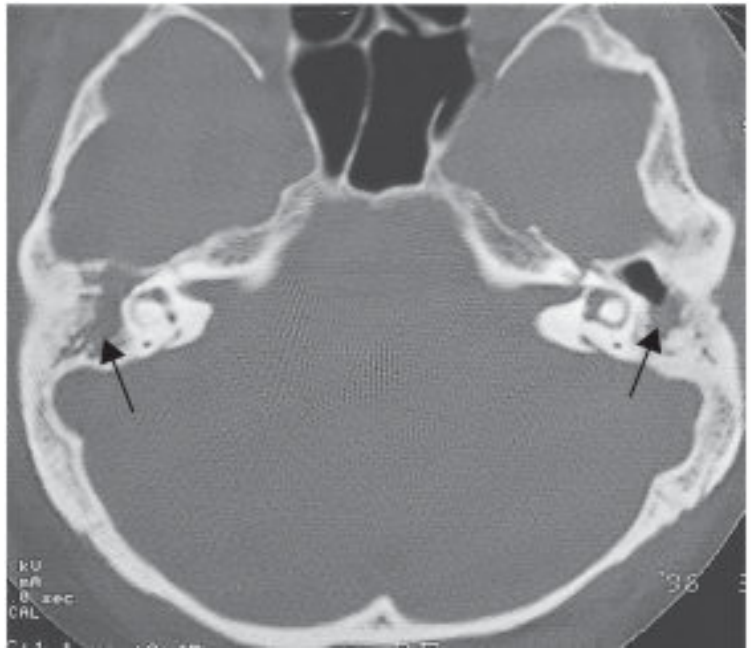
Radiological Assessment

High-Resolution CT Scan:

- Extent of disease
- Ossicular chain status
- Facial canal dehiscence
- Tegmen erosion
- Labyrinthine fistula
- Mastoid pneumatization

MRI (When Indicated):

- Intracranial complications
- Differentiate cholesteatoma from granulation
- DWI sequence for cholesteatoma detection
- Soft tissue characterization
- Labyrinthine involvement

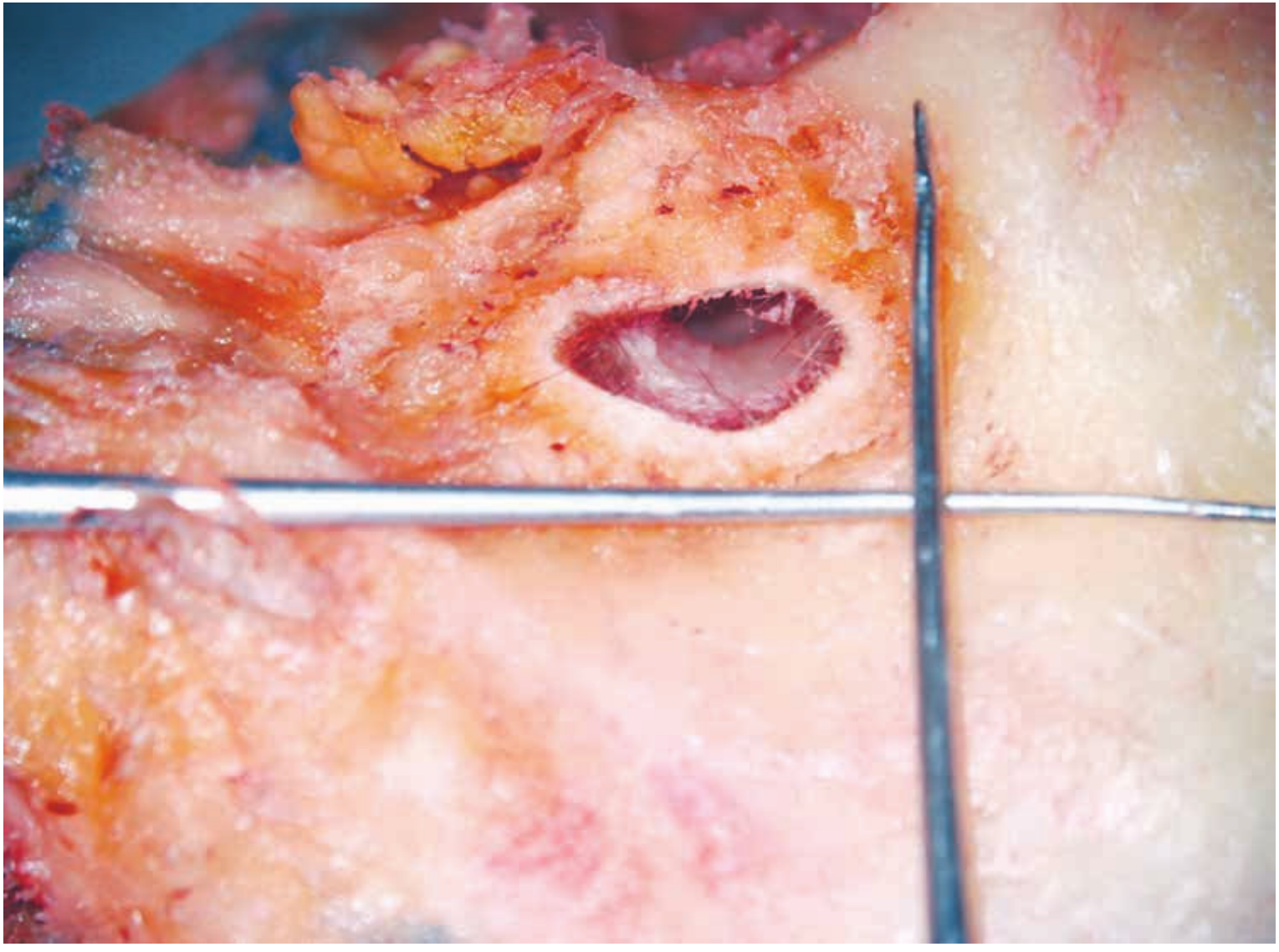


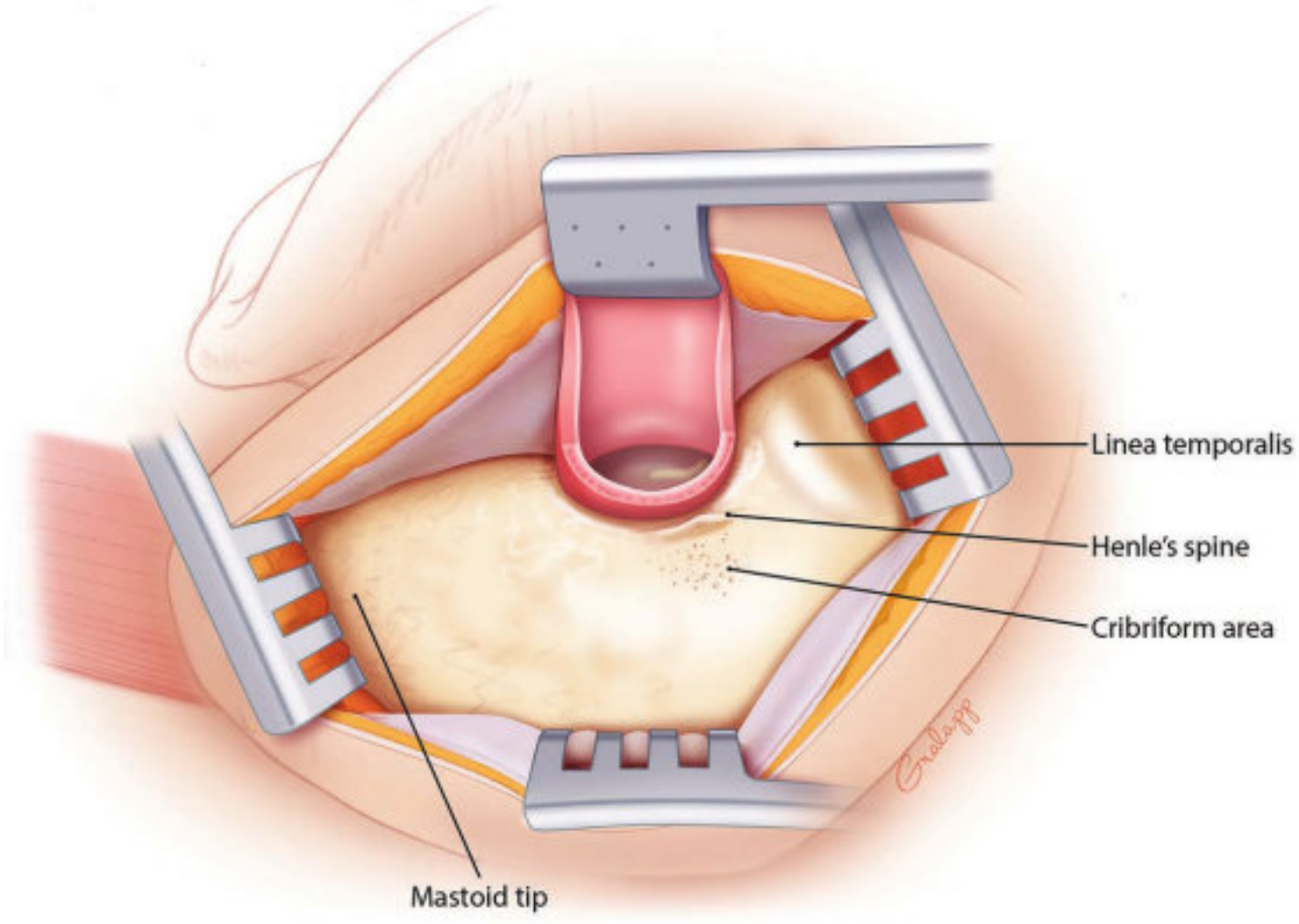
Medical Management

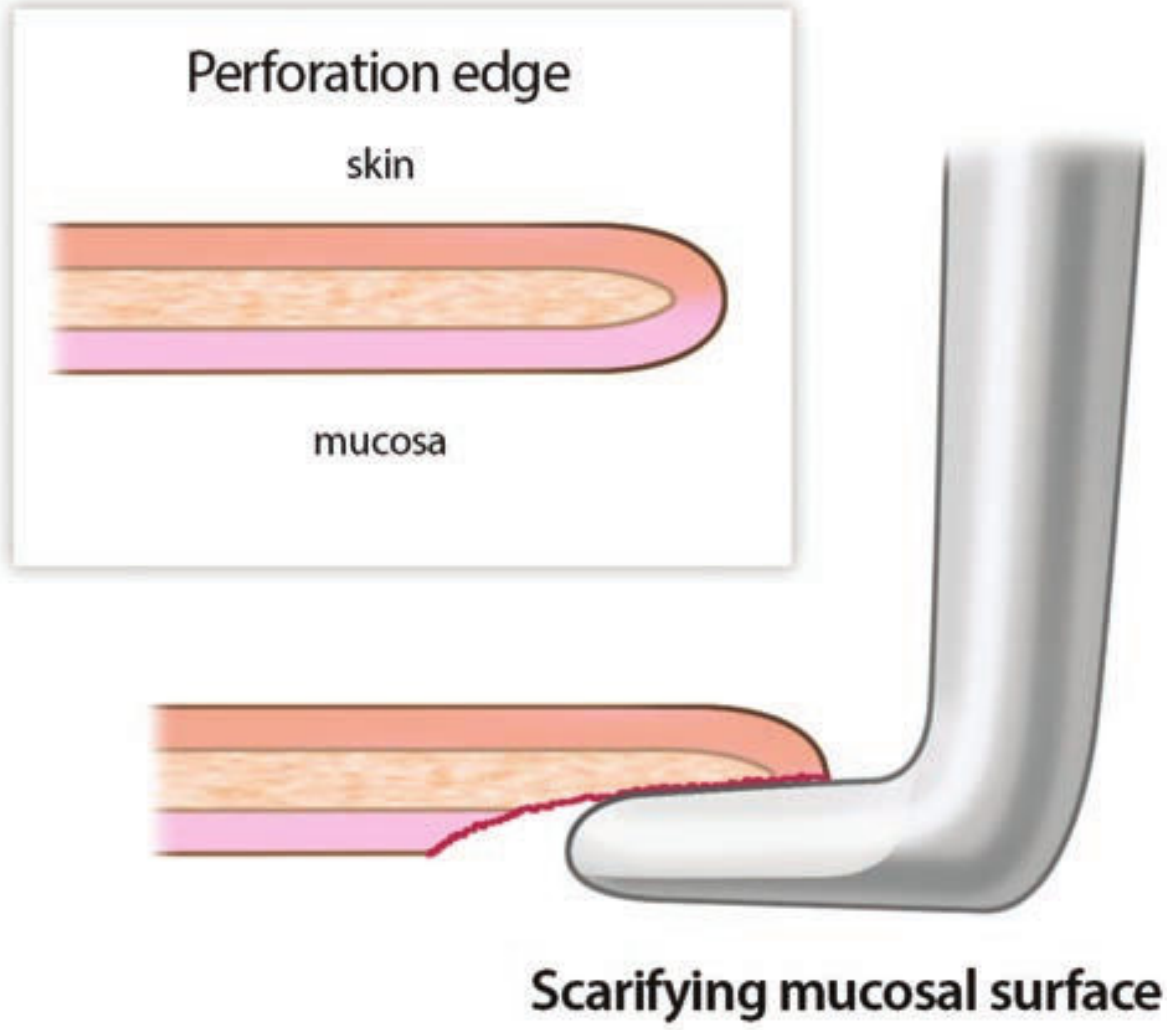
- Principles of treatment:
  - Aural toilet and dry ear technique
  - Topical antimicrobial therapy
  - Systemic antibiotics (in selected cases)
  - Control of predisposing factors
- Topical therapy options:
  - Quinolones (ciprofloxacin, ofloxacin)
  - Aminoglycosides (with caution)
  - Combination antibiotics with steroids
  - Antiseptics (boric acid, acetic acid)
- Evidence-based protocols for optimal duration

Surgical Management: Tubotympanic CSOM

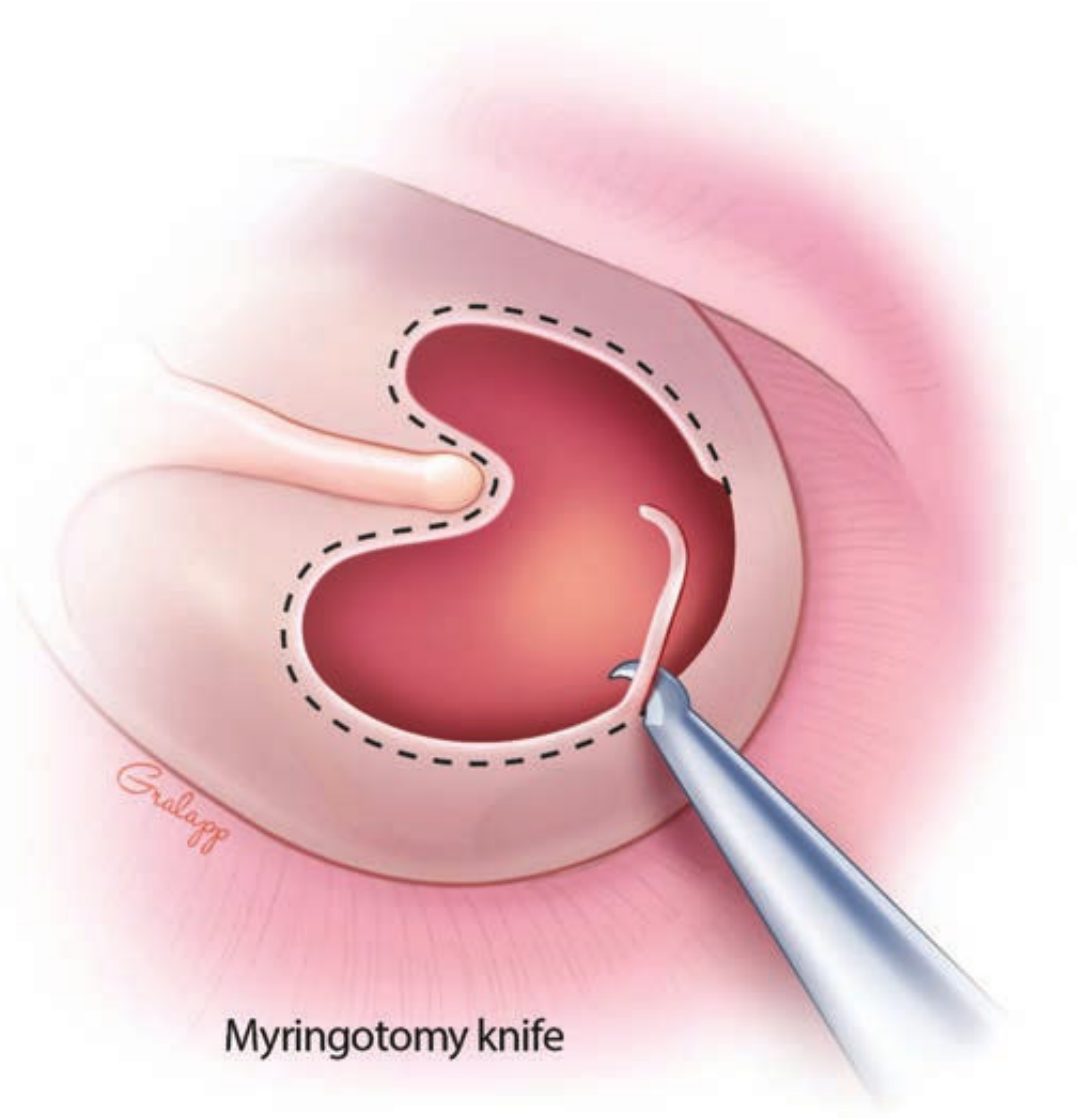
- Myringoplasty:
  - Repair of tympanic membrane perforation
  - Graft options: temporalis fascia, cartilage, perichondrium
  - Success rate: 80-90% in dry ears
- Tympanoplasty:
  - Type I: Intact ossicular chain
  - Type II-V: Ossicular chain reconstruction
  - Hearing outcomes correlate with ossicular status
- Adjunctive procedures:
  - Cortical mastoidectomy (when indicated)
  - Eustachian tube assessment and management

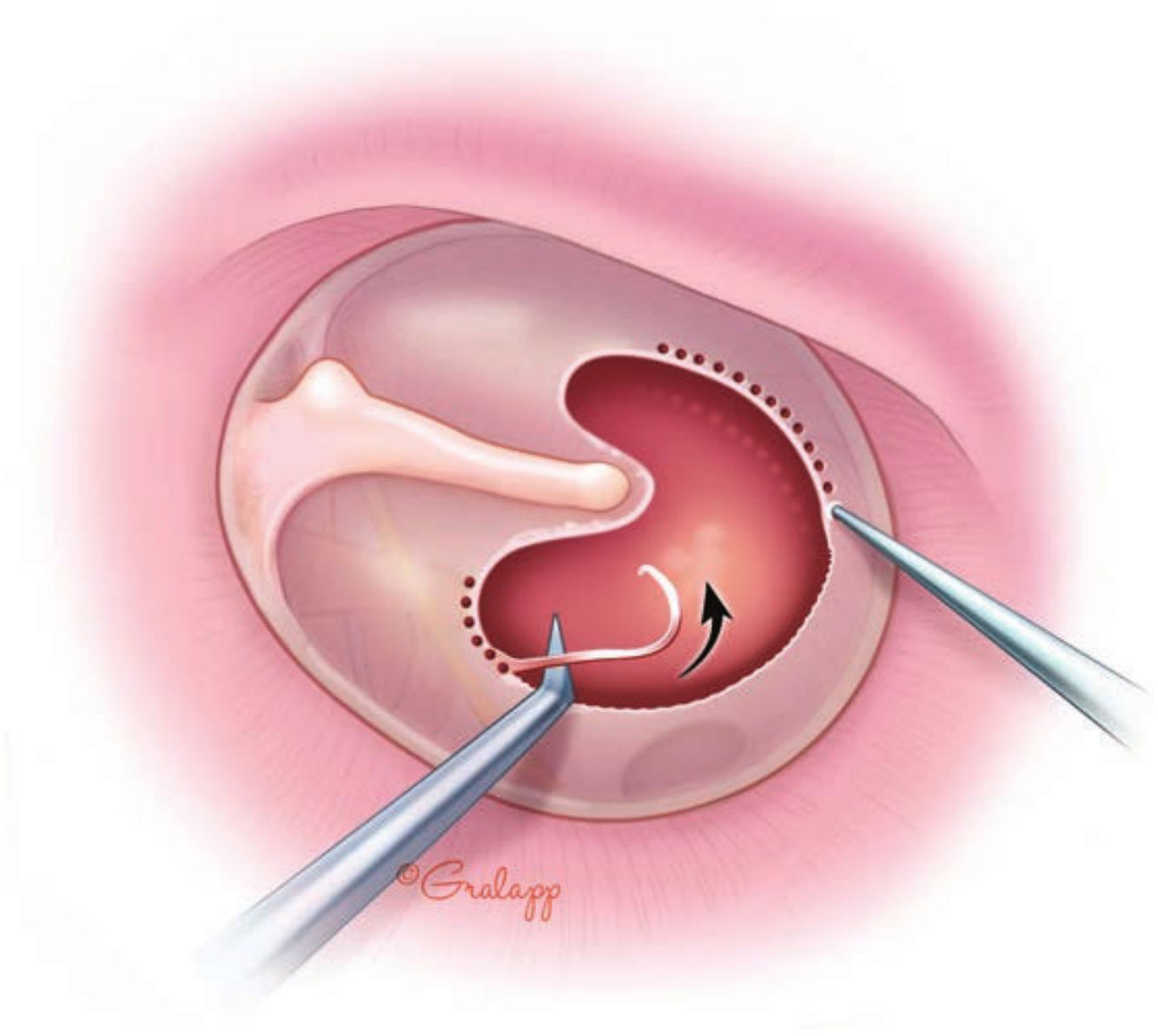


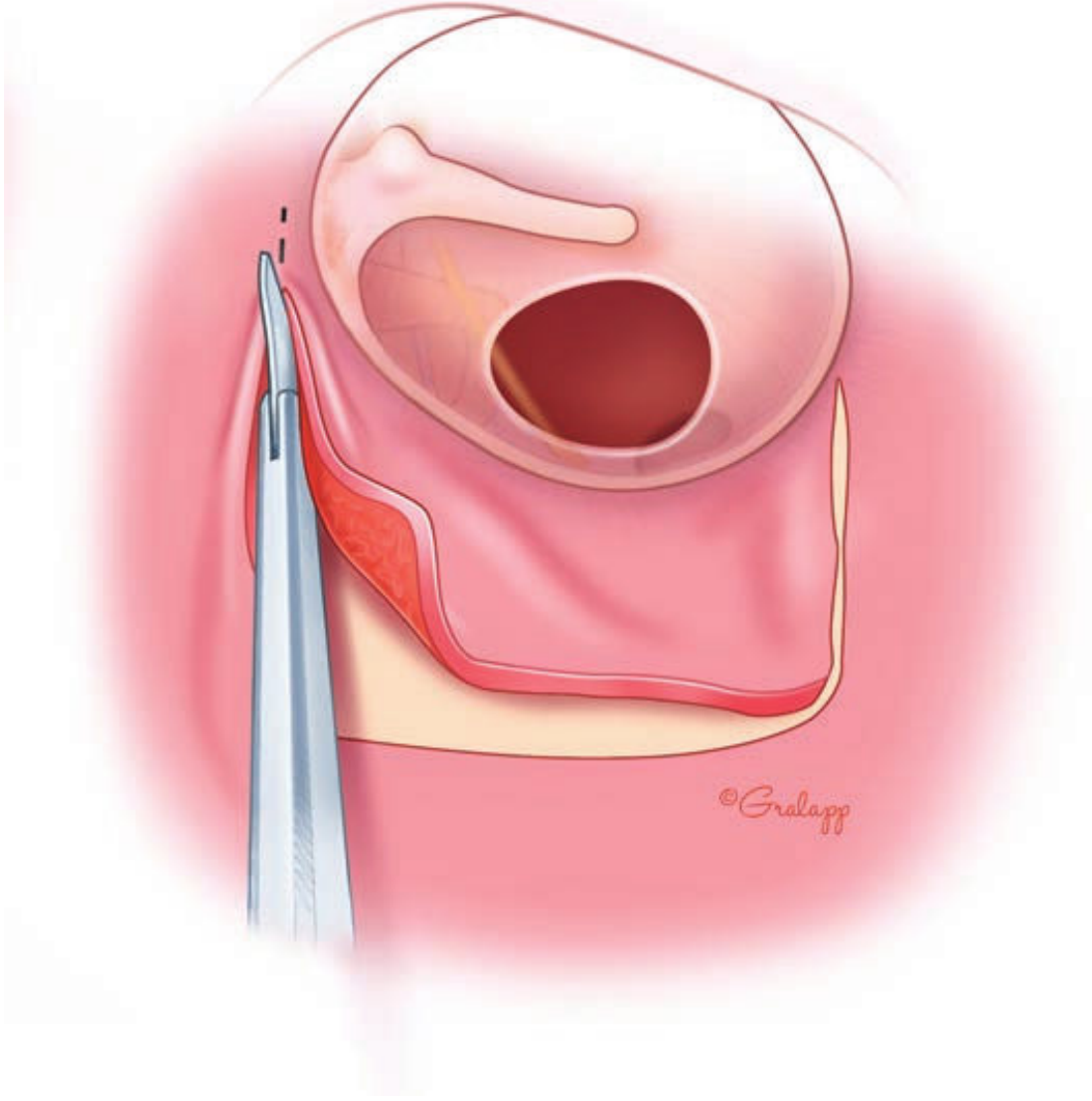

Linea temporalis
Henle's spine
Cribriform area
Mastoid tip

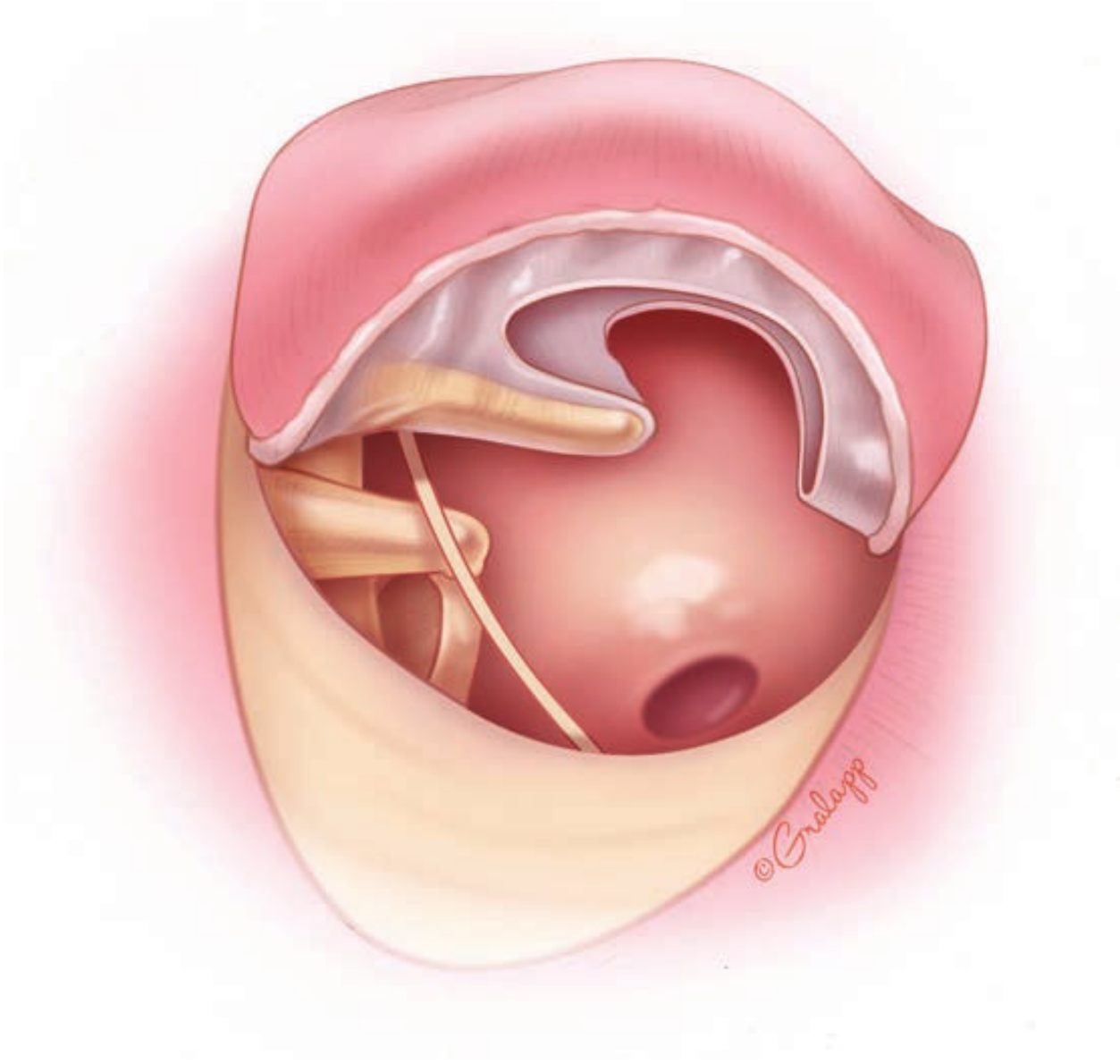


Scarifying mucosal surface

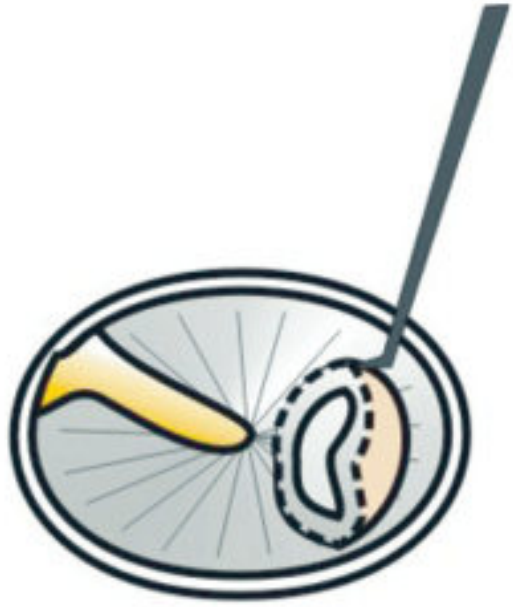

Myringotomy knife

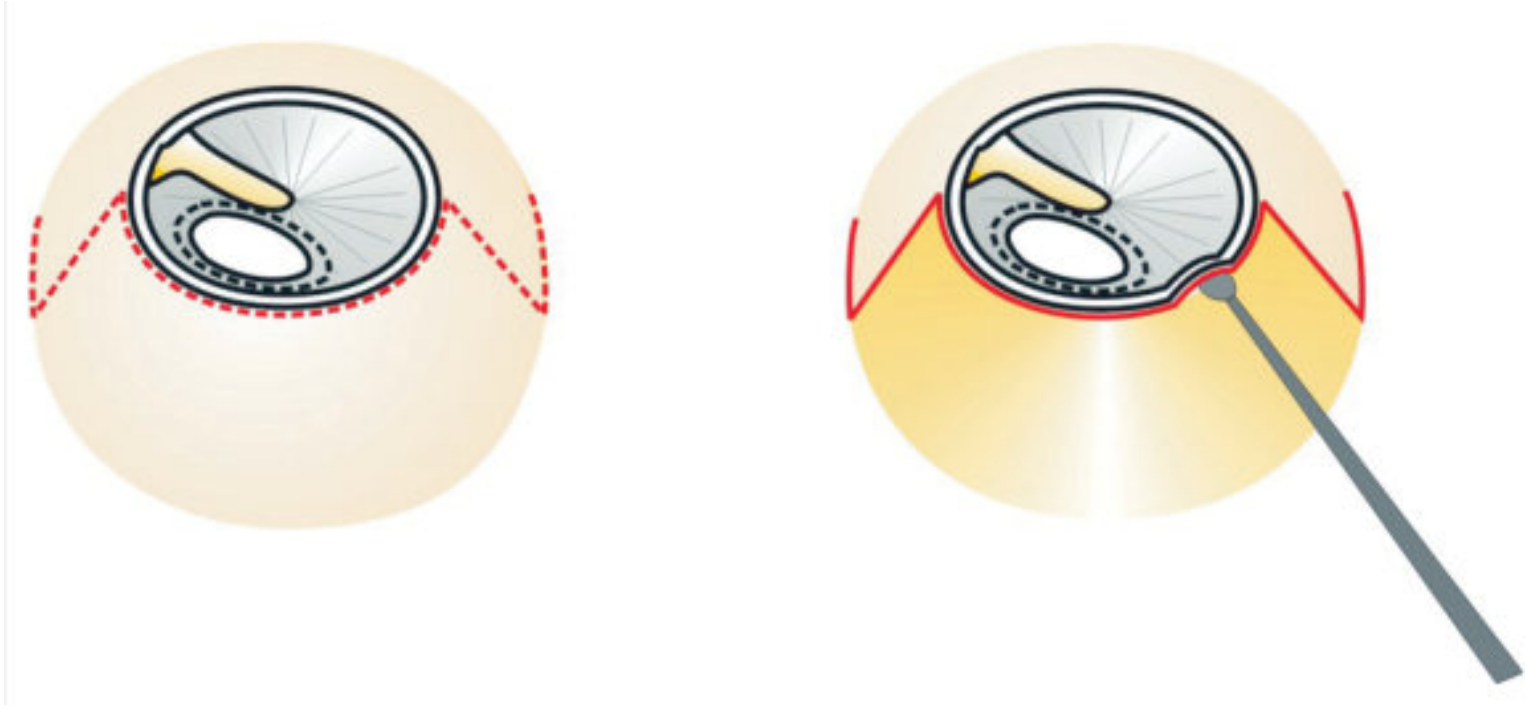

©Gralapp


©Gralapp


©Grolaff

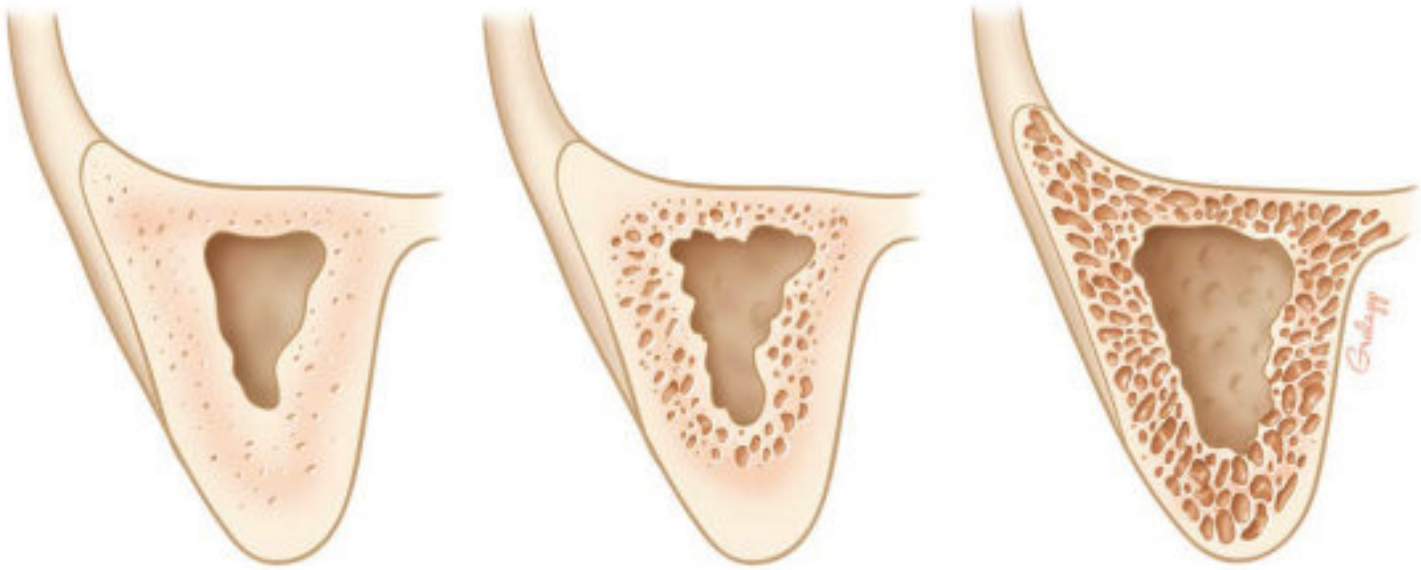

©Gralapp





Surgical Management: Atticoantral CSOM

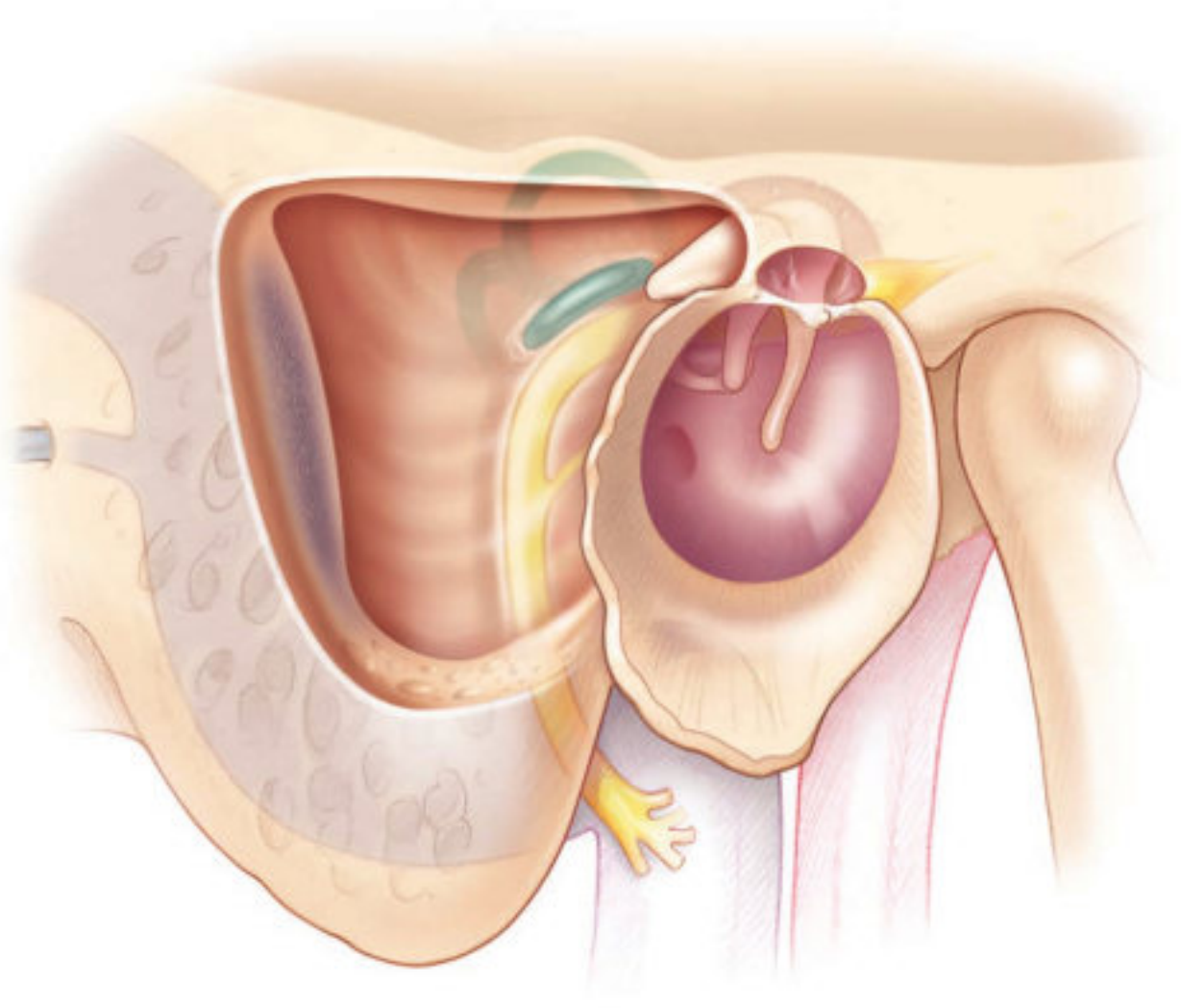
- Canal wall up (CWU) mastoidectomy:
  - Preserves posterior canal wall
  - Better anatomical configuration
  - Lower risk of cavity problems
  - Higher risk of residual/recurrent disease
- Canal wall down (CWD) mastoidectomy:
  - Removes posterior canal wall
  - Creates a common cavity
  - Better disease visualization
  - Lower recurrence rates
  - Requires lifetime maintenance

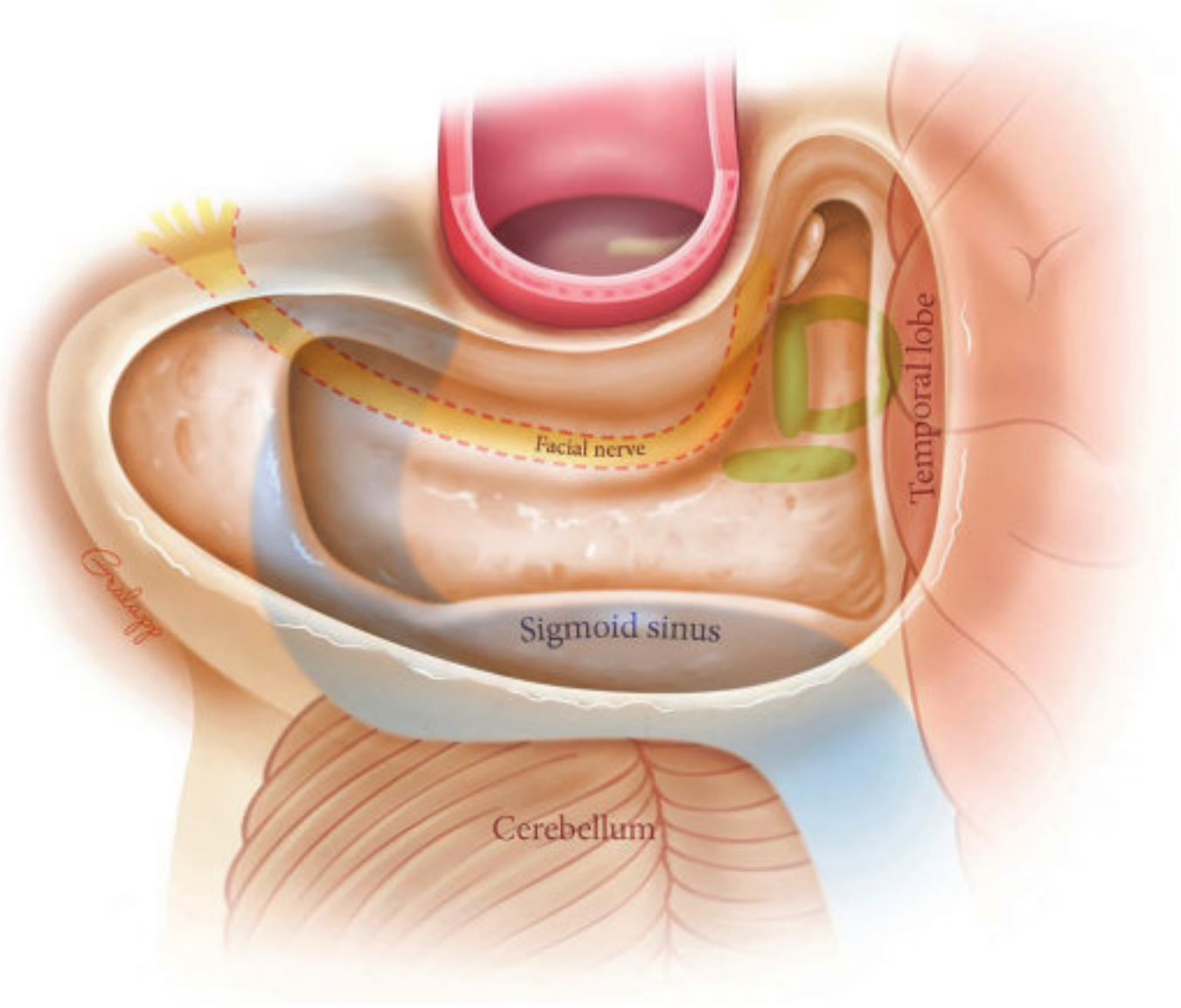


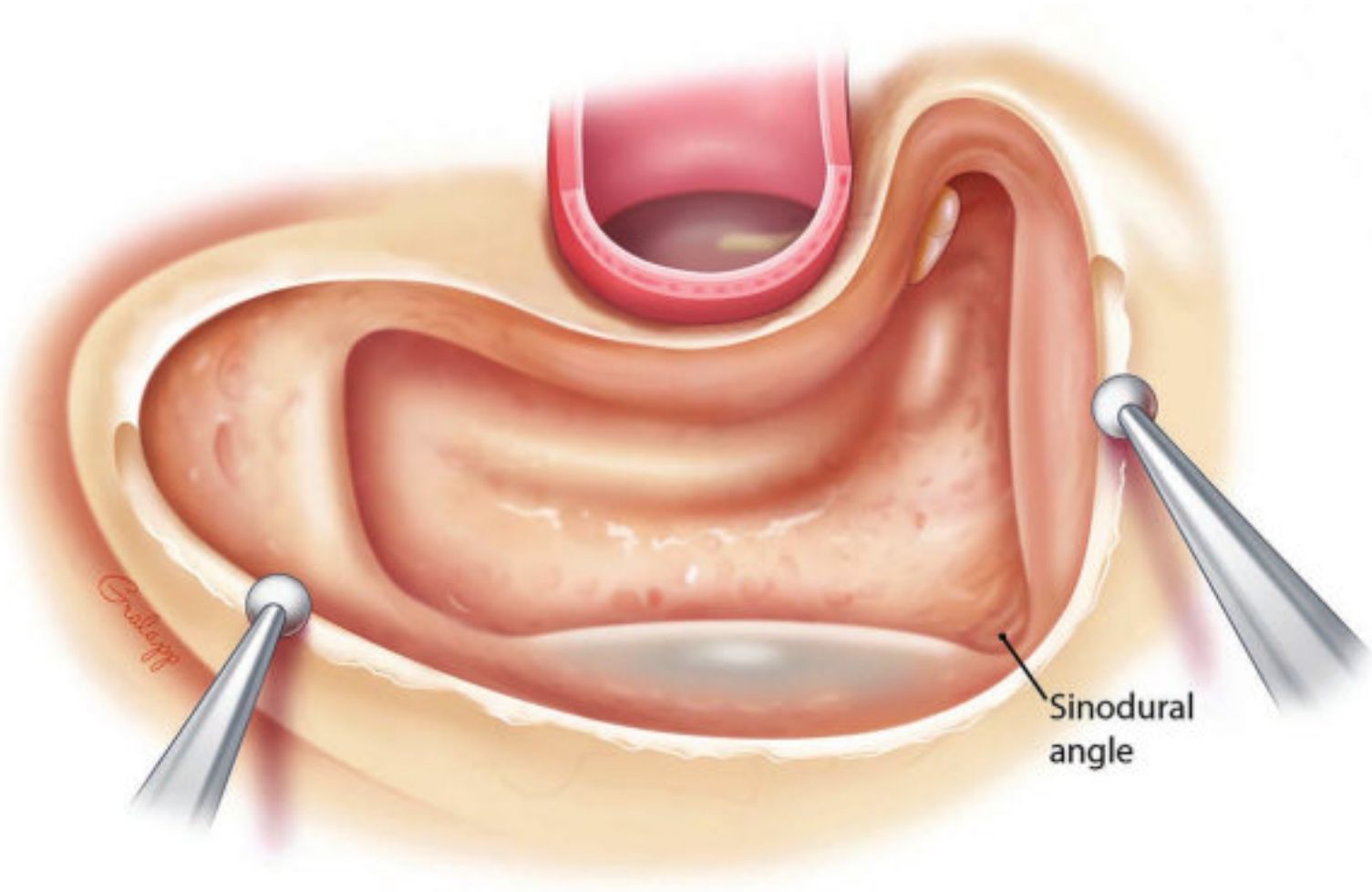
Hypopneumatized

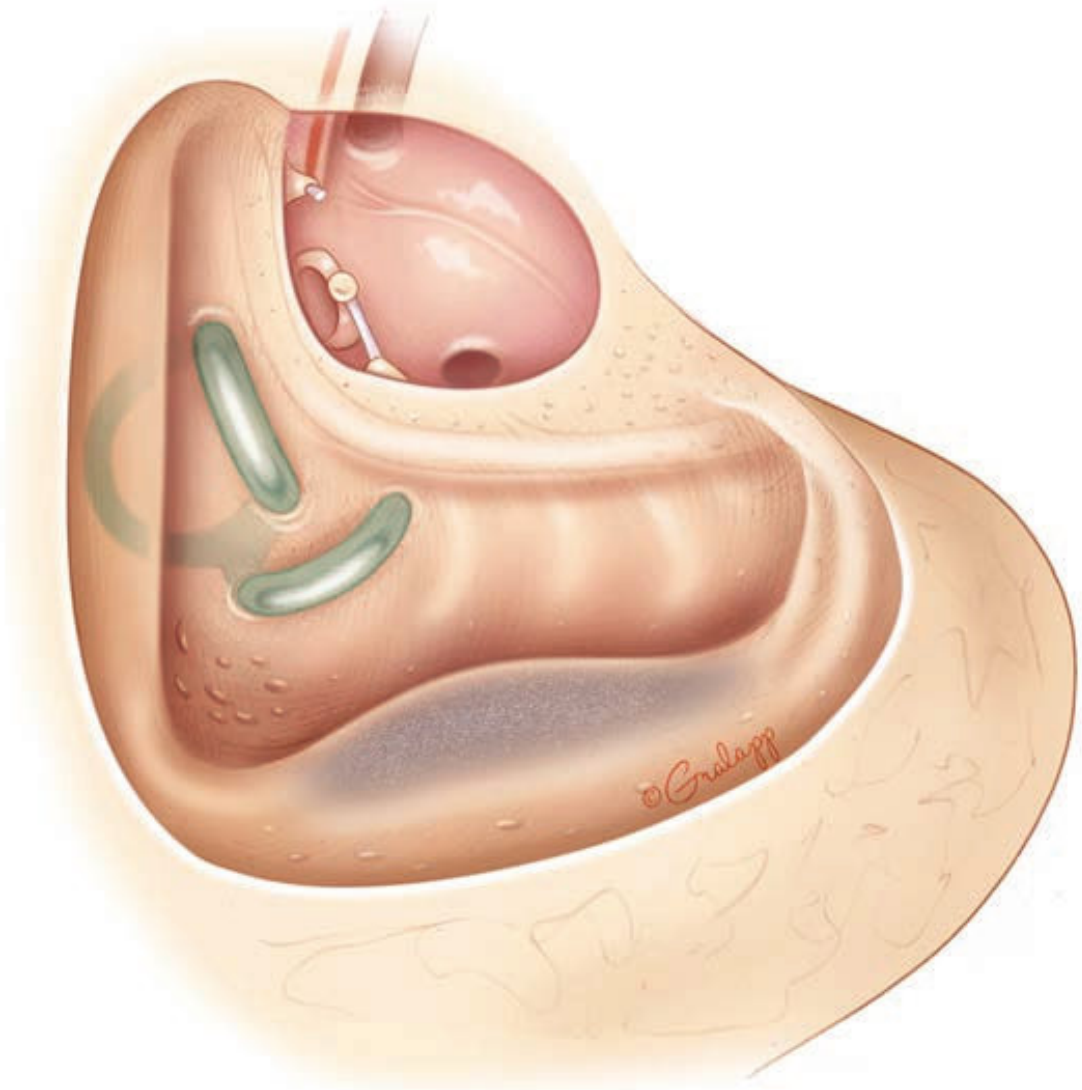
Average pneumatization

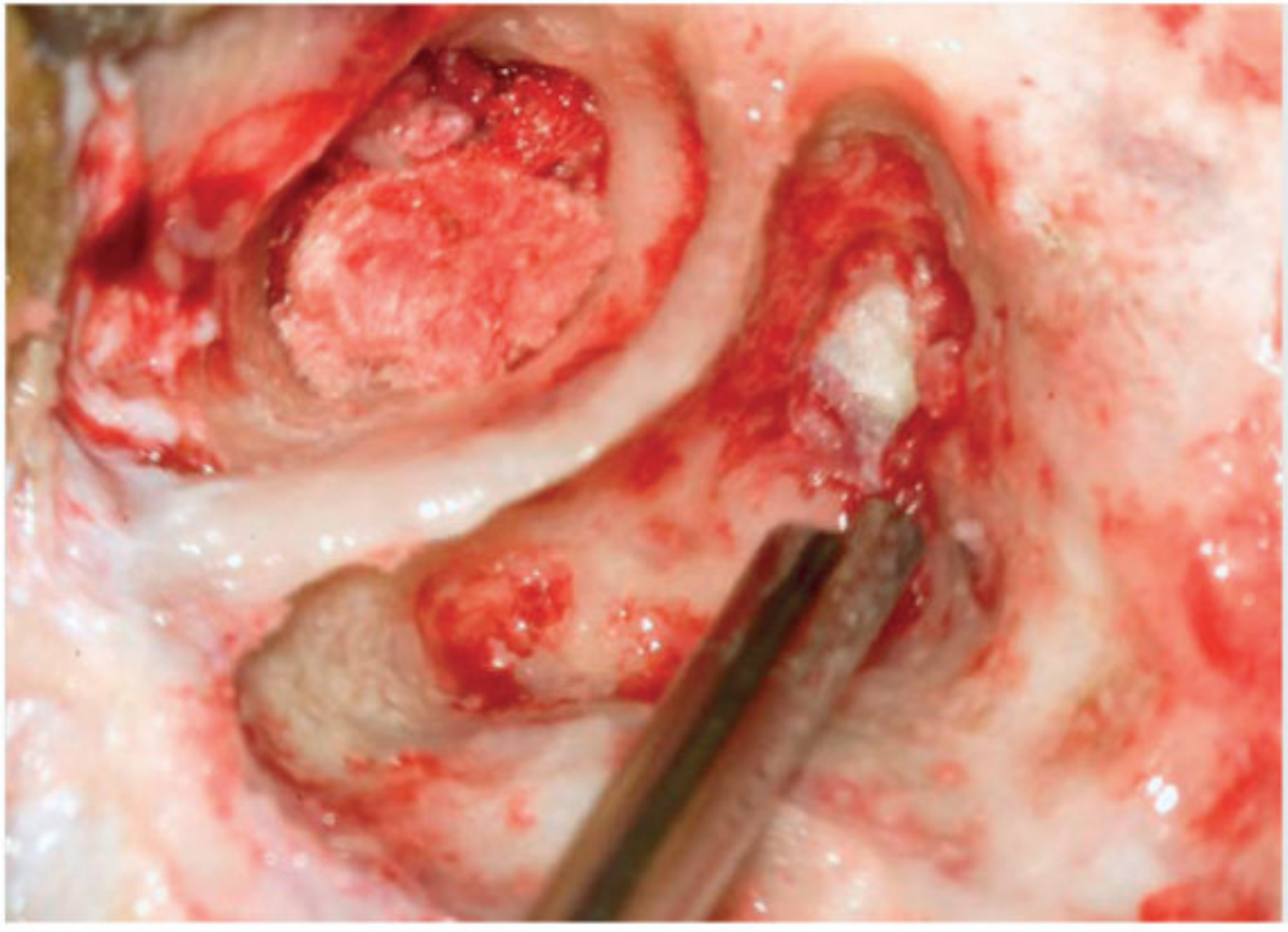
Hyperpneumatized

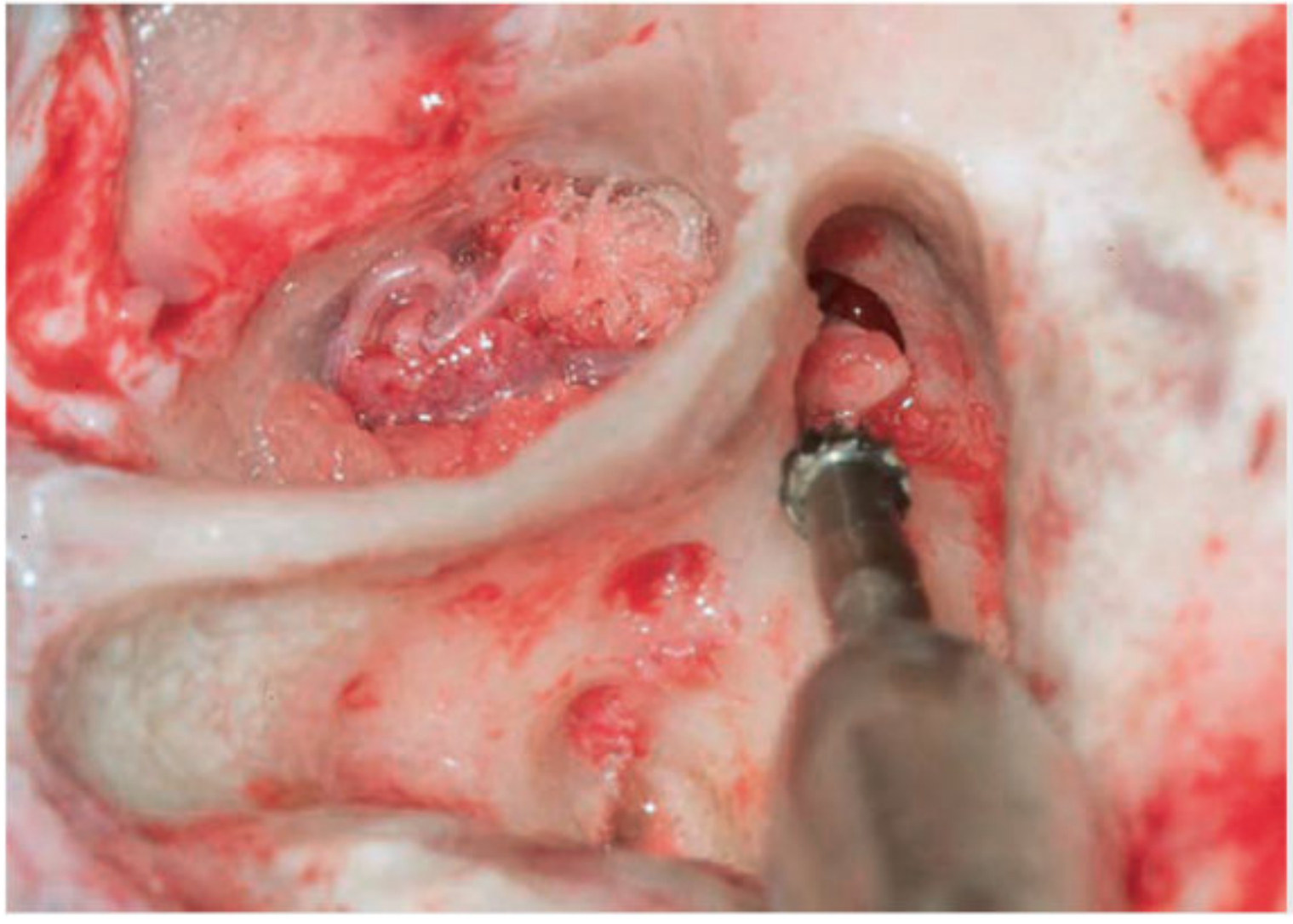


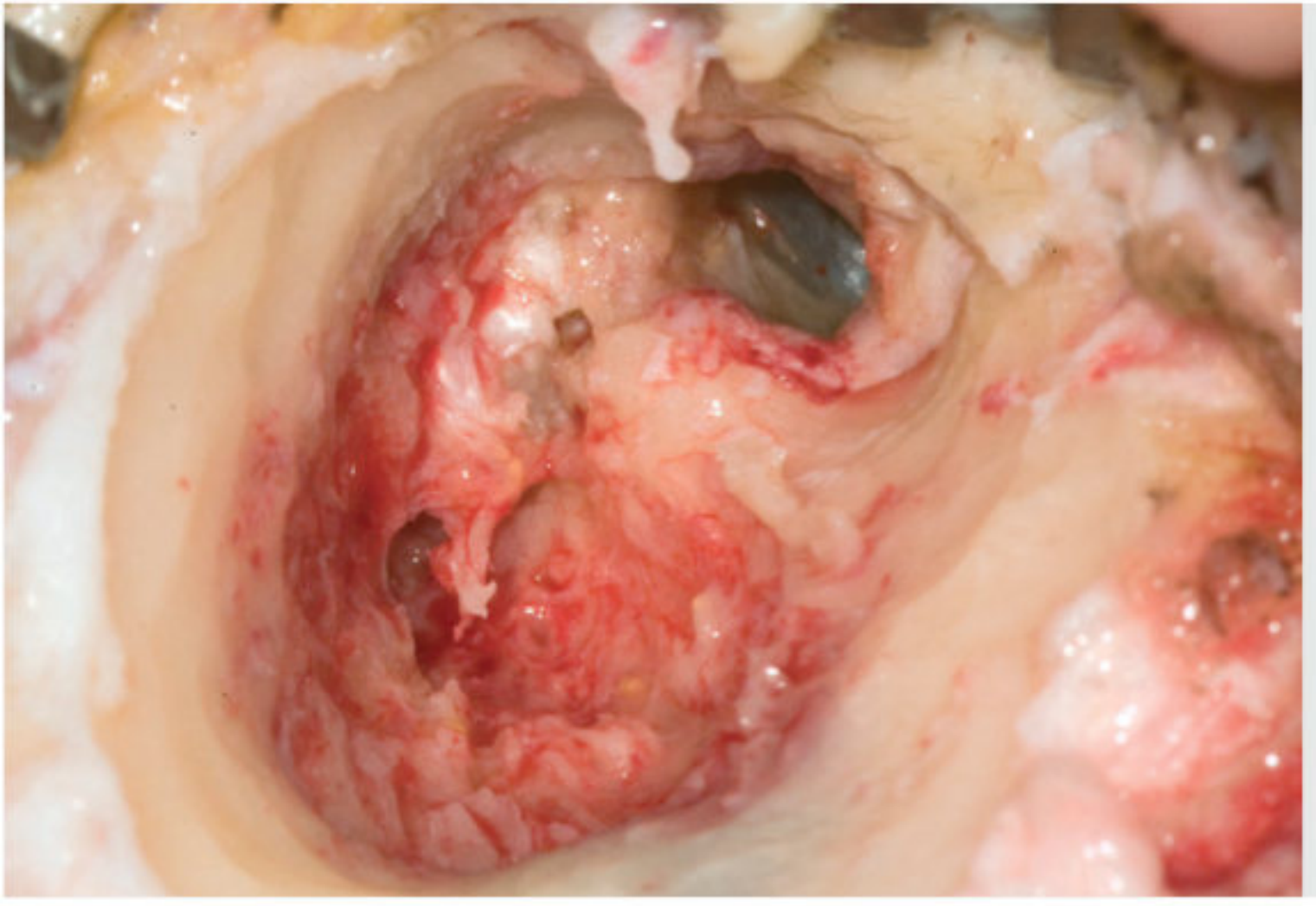

Facial nerve
Temporal lobe
Sigmoid sinus
Cerebellum


Sinodural
angle


©Gralapp

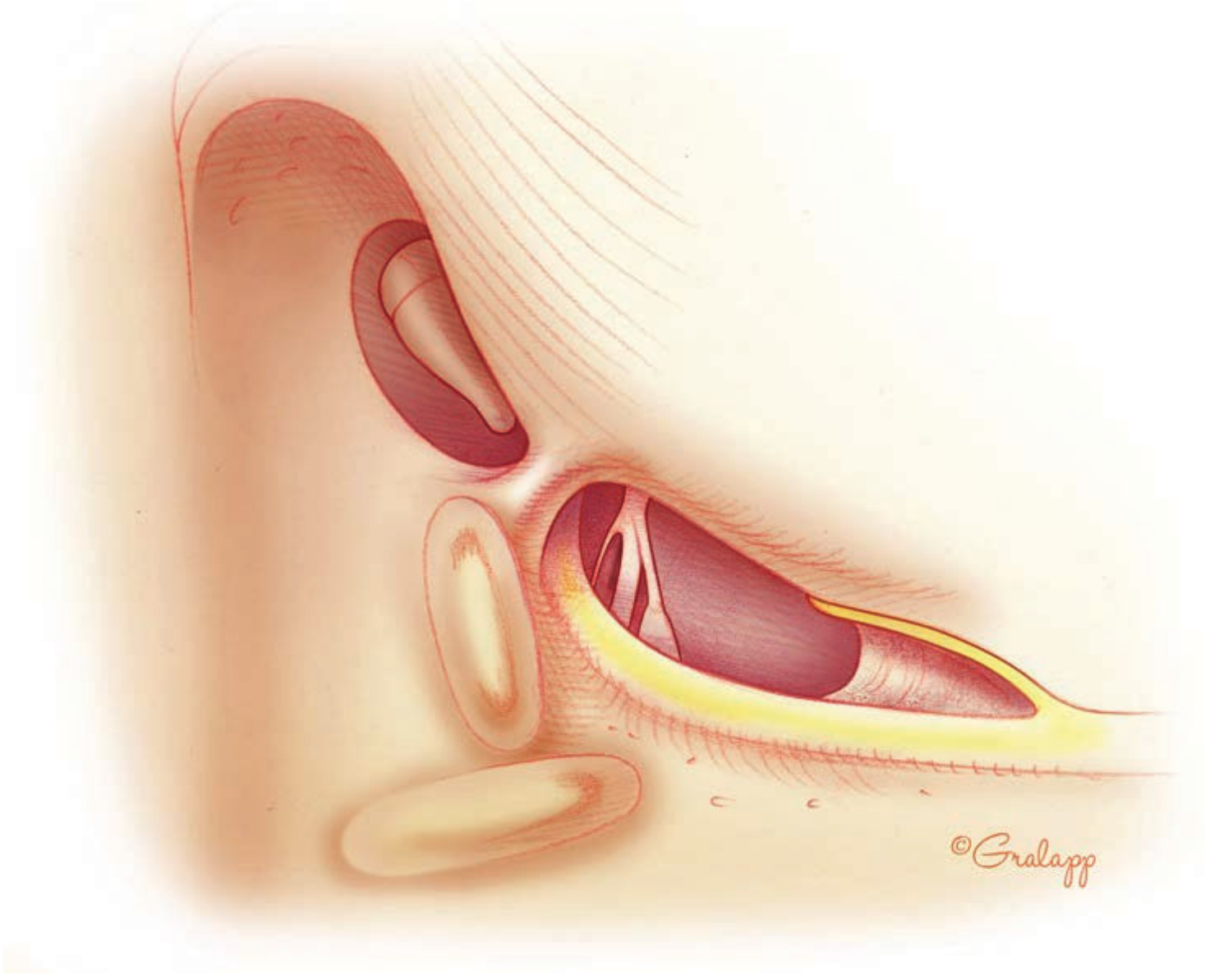






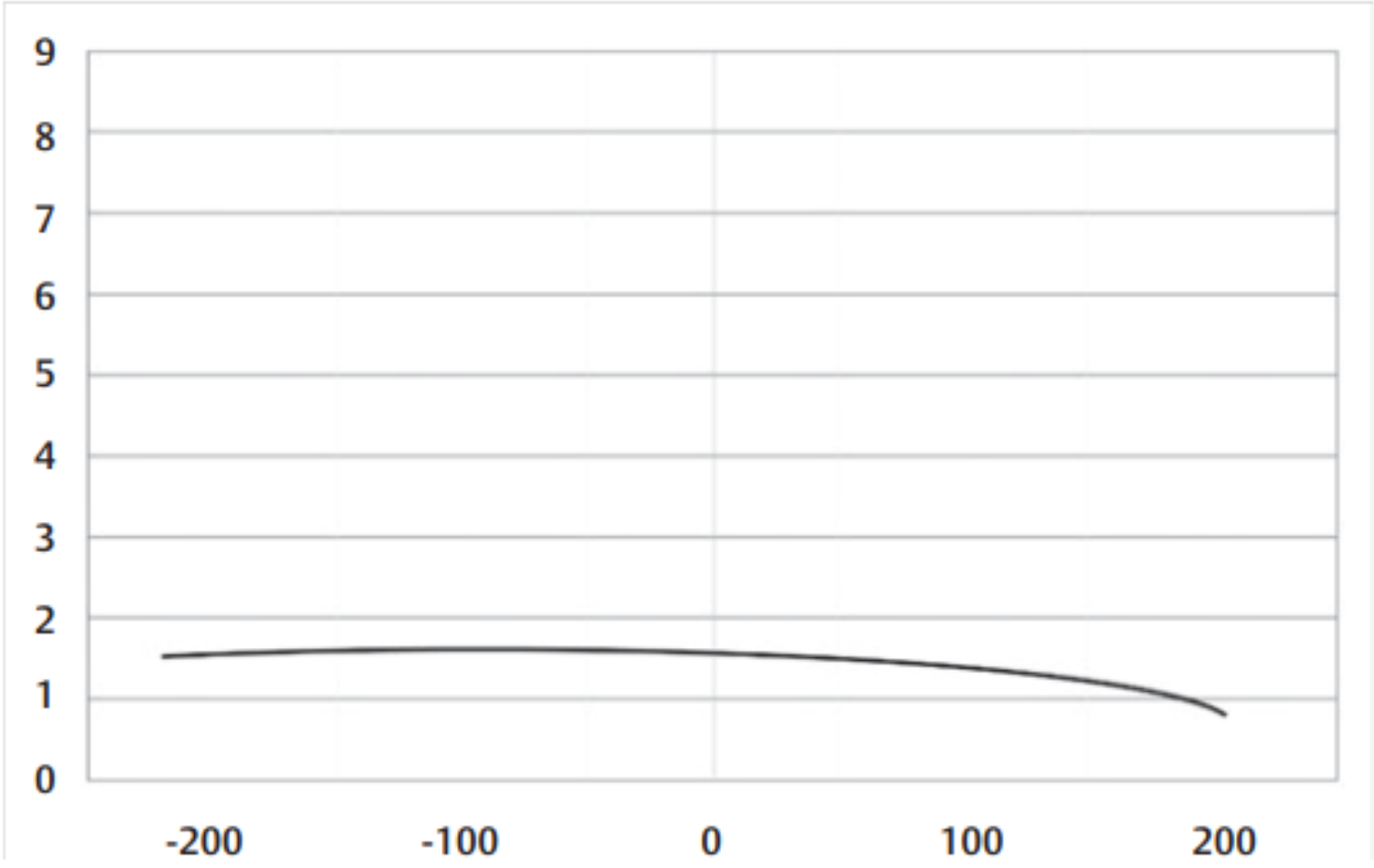
Newer Techniques and Advances

- Endoscopic ear surgery:
  - Minimally invasive approach
  - Superior visualization of hidden recesses
  - Reduced morbidity
  - Shorter hospital stay
- Ossicular reconstruction:
  - Titanium prostheses
  - Hydroxyapatite implants
  - 3D-printed ossicular replacements
  - Bioactive glass
- Cartilage tympanoplasty techniques
- Bone-anchored hearing devices for rehabilitation


©Gralapp

Outcomes and Prognosis

- Successful outcomes defined by:
  - Dry, disease-free ear
  - Intact tympanic membrane
  - Improved hearing
  - Prevention of recurrence and complications
- Prognostic factors:
  - Disease type (tubotympanic vs. atticoantral)
  - Extent of disease
  - Eustachian tube function
  - Patient compliance
  - Surgical expertise
  - Appropriate follow-up


9
8
7
6
5
4
3
2
1
0
-200
-100
0
100
200

Follow-up Protocol

- Short-term follow-up:
  - Weekly for first month
  - Monthly for 3-6 months
  - Assessment of healing and disease control
- Long-term follow-up:
  - Every 6-12 months
  - Audiometric evaluation
  - Otoscopic examination
  - Early detection of recurrence
- Patient education:
  - Water precautions
  - Early recognition of warning signs
  - Adherence to treatment regimen

Future Directions

- Biofilm-targeted therapies:
  - Quorum sensing inhibitors
  - Biofilm dispersal agents
  - Nanoparticle delivery systems
- Tissue engineering:
  - Stem cell approaches for TM regeneration
  - Bioactive scaffolds
  - Growth factor delivery
- Molecular diagnostics:
  - Rapid pathogen identification
  - Antibiotic resistance profiling
  - Host immune response assessment
- Telemedicine for remote management and follow-up

Surgical Management of Chronic Suppurative Otitis Media

Prof. Dr. Santhosh Kumar Rajamani

Department of Otorhinolaryngology
MIMER Medical College, Talegoan D, Pune, MH

March 2, 2025

Outline

Overview of CSOM

- Chronic Suppurative Otitis Media (CSOM):
  - Inflammation of middle ear and mastoid for ¿12 weeks
  - Persistent/recurrent otorrhea through perforated TM
  - Significant cause of morbidity globally
- Two main types:
  - Tubotympanic (mucosal, safe) type
  - Atticoantral (squamous, unsafe) type
- Surgical intervention indicated when:
  - Medical management fails
  - Persistent disease/discharge
  - Complications present or imminent
  - Hearing rehabilitation needed

Preoperative Assessment

Clinical Evaluation:

- Otoscopic/microscopic examination
- Assessment of middle ear status
- Eustachian tube function
- Contralateral ear status
- Nasal/sinus pathologies

Investigations:

- Pure tone audiometry
- Tympanometry (when applicable)
- Imaging (HRCT temporal bone)
- Culture and sensitivity
- Tuning fork tests

Goals of Surgical Management

- Primary goals:
  - Eradication of disease process
  - Creation of dry, safe ear
  - Prevention of recurrence and complications
- Secondary goals:
  - Restoration of hearing mechanism
  - Reconstruction of tympanic membrane
  - Maintenance/improvement of cochlear function
  - Preservation of anatomy where possible
- Tertiary considerations:
  - Minimal morbidity
  - Cosmetic outcomes
  - Quality of life improvement

Surgical Approach Selection

- Factors influencing surgical approach:
  - Type and extent of disease
  - Status of ossicular chain
  - Presence of complications
  - Eustachian tube function
  - Patient age and comorbidities
  - Previous surgical interventions
  - Hearing status of contralateral ear
  - Surgeon's experience and preference
- Patient-specific considerations:
  - Expectations and compliance
  - Occupation and lifestyle
  - Ability to attend follow-up

Myringoplasty

- Definition: Surgical repair of tympanic membrane perforation
- Indications:
  - Central perforation
  - Dry ear for ¿3 months
  - Absence of active middle ear disease
  - Adequate eustachian tube function
- Surgical approaches:
  - Transcanal
  - Endaural
  - Postauricular
- Graft placement techniques:
  - Underlay (most common)
  - Overlay
  - Inlay (for small perforations)

Graft Materials for Myringoplasty

Autologous Materials:

- Temporalis fascia (gold standard)
- Tragal perichondrium
- Tragal cartilage
- Fascia lata
- Vein graft
- Fat (small perforations)

Properties of Ideal Graft:

- Low metabolic rate
- Good tensile strength
- Easily available
- Adequate thickness
- Good take-up rate
- Acoustic properties similar to TM

Tympanoplasty Classification

- Based on ossicular reconstruction (Wullstein classification):
  - Type I: Intact ossicular chain
  - Type II: Erosion of malleus, graft placed on incus
  - Type III: Erosion of malleus and incus, graft placed on stapes
  - Type IV: Mobile footplate, sound protection for round window
  - Type V: Fenestration of lateral semicircular canal
- Modified classifications commonly used in practice:
  - Type I: Myringoplasty only
  - Type II: Ossiculoplasty with partial ossicular replacement
  - Type III: Ossiculoplasty with total ossicular replacement

Ossicular Chain Reconstruction

- Types of ossicular defects:
  - Incudostapedial joint discontinuity
  - Eroded incus
  - Absence of incus and malleus head
  - Absence of superstructure of stapes
- Reconstruction options:
  - Autologous ossicles
  - Cortical bone
  - Cartilage
  - Partial Ossicular Replacement Prosthesis (PORP)
  - Total Ossicular Replacement Prosthesis (TORP)
- Biomaterials:
  - Titanium
  - Hydroxyapatite
  - Plastipore
  - Bioactive glass

Cortical Mastoidectomy

- Indications with tubotympanic CSOM:
  - Sclerotic mastoid
  - Persistent/recurrent disease
  - Failure of previous tympanoplasty
  - Evidence of mastoid reservoirs of infection
- Procedure components:
  - Postauricular incision
  - Exposure of mastoid cortex
  - Removal of diseased air cells
  - Preservation of posterior canal wall
  - Establishment of adequate drainage
  - Combined with tympanoplasty
- Controversial aspects:
  - Routine vs. selective approach
  - Impact on graft take rate

Canal Wall Up Mastoidectomy

- Combined Approach Tympanoplasty (CAT)
- Indications:
  - Limited attic/antral cholesteatoma
  - Good eustachian tube function
  - No previous surgery
  - Good hearing potential
  - Reliable follow-up
- Advantages:
  - Preserves normal anatomy
  - Avoids cavity problems
  - Better hearing results
  - Water activities permitted
- Disadvantages:
  - Higher recurrence rate (5-20%)
  - Limited visualization
  - Second-look surgery often needed
  - Technically demanding

Canal Wall Down Mastoidectomy

- Modified Radical Mastoidectomy / Radical Mastoidectomy
- Indications:
  - Extensive cholesteatoma
  - Recurrent disease
  - Complications present
  - Poor eustachian tube function
  - Limited follow-up capability
  - Failed canal wall up procedure
- Advantages:
  - Lower recurrence rate (5-10%)
  - Better visualization of disease
  - Single-stage procedure
  - Easier postoperative monitoring
- Disadvantages:
  - Cavity problems (debris, drainage)
  - Water precautions
  - Potential hearing aid difficulties
  - Poorer hearing outcomes

Cavity Management in CWD

- Principles of cavity creation:
  - Adequate meatoplasty
  - Smooth cavity walls
  - Elimination of overhangs
  - Low facial ridge
  - Adequate drainage
- Cavity obliteration techniques:
  - Muscle flap
  - Bone pâté
  - Cartilage
  - Hydroxyapatite granules
  - Bioactive glass
- Goals of obliteration:
  - Reduce cavity size
  - Minimize maintenance
  - Improve hearing aid fitting

Management of Complications

- Facial nerve paralysis:
  - Decompression
  - Removal of cholesteatoma matrix
  - Grafting if needed
- Labyrinthine fistula:
  - Matrix removal techniques
  - Fistula repair options
  - Staged approaches
- Intracranial complications:
  - Drainage of abscess
  - Dural repair
  - Management of thrombophlebitis
  - Coordinated approach with neurosurgery

Endoscopic Ear Surgery

- Principles and advantages:
  - Minimally invasive approach
  - Superior visualization of hidden recesses
  - Reduced morbidity
  - Enhanced teaching capabilities
- Applications in CSOM:
  - Transcanal endoscopic myringoplasty
  - Endoscopic tympanoplasty
  - Endoscopic atticotomy
  - Endoscopic-assisted mastoidectomy
  - Second-look procedures
- Limitations:
  - One-handed technique
  - Learning curve
  - Bleeding control challenges
  - Limited for extensive mastoid disease

Cartilage Tympanoplasty

- Techniques:
  - Palisade technique
  - Island technique
  - Shield technique
  - Composite cartilage-perichondrium graft
- Indications:
  - Recurrent perforations
  - Total/near-total perforations
  - Anterior perforations
  - Poor eustachian tube function
  - Adhesive otitis media
  - Atelectatic TM
- Advantages:
  - Greater mechanical stability
  - Resistance to negative ME pressure
  - Higher graft take rates
  - Reduced recurrence rates

Advances in Ossicular Reconstruction

- Modern prostheses:
  - Titanium PORP/TORP
  - Angular prostheses
  - Clip prostheses
  - Adjustable-length prostheses
- Biomaterial advances:
  - 3D-printed ossicular replacements
  - Bioactive glass
  - Hydroxyapatite composites
  - Titanium-hydroxyapatite hybrids
- Interposition techniques:
  - Cartilage interposition
  - Malleus-stapes assembly
  - Incus transposition

Laser-Assisted Otologic Surgery

- Types of lasers:
  - CO_2 laser
  - KTP laser
  - Argon laser
  - Er:YAG laser
- Applications:
  - Cholesteatoma matrix removal
  - Stapedotomy
  - Adhesion lysis
  - Ossicular mobilization
  - Middle ear tumor excision
- Advantages:
  - Precision
  - Minimal thermal damage
  - Reduced bleeding
  - Better preservation of structures

Postoperative Care

- Immediate care:
  - Mastoid dressing
  - Antibiotics (systemic/topical)
  - Pain management
  - Activity restrictions
  - Water precautions
- Follow-up protocol:
  - First visit: 7-10 days (suture removal)
  - Packing removal: 2-3 weeks
  - Regular cavity cleaning (if CWD)
  - Audiological assessment: 8-12 weeks
  - Long-term: 6-monthly then yearly
- Cavity management:
  - Microscopic cleaning
  - Prevention of infections
  - Aural toilet instructions

Outcomes and Success Rates

Anatomical Success:

- Myringoplasty: 80-95%
- Cartilage TM: 90-97%
- Ossicular reconstruction: 60-80%
- Disease eradication:
  - CWU: 80-90%
  - CWD: 90-95%

Functional Success:

- ABG closure:
  - Type I: ¡20 dB in 90%
  - Type II: ¡30 dB in 70%
  - Type III: ¡30 dB in 60%
- Factors affecting outcomes:
  - Technique
  - Disease extent
  - Eustachian tube function
  - Ossicular status
  - Surgical expertise

Complications of Surgery

- Early complications:
  - Bleeding
  - Infection
  - Graft displacement
  - Facial nerve injury
  - Perichondritis
  - Taste disturbance (chorda tympani)
- Late complications:
  - Recurrent/residual disease
  - Lateralization of graft
  - Blunting/anterior angle closure
  - Prosthesis extrusion
  - Persistent perforation
  - Sensorineural hearing loss
  - Persistent cavity problems

Revision Surgery

- Common causes of failure:
  - Persistent eustachian tube dysfunction
  - Inadequate removal of disease
  - Technical errors
  - Infection
  - Poor graft vascularization
- Approach to revision:
  - Complete reassessment
  - Selection of appropriate technique
  - Consideration of more robust grafts
  - Management of granulation/fibrosis
  - Lower threshold for CWD in recurrent cholesteatoma
- Role of second-look procedures:
  - Planned vs. as needed
  - Timing (9-12 months)
  - Endoscopic approaches

Pediatric Considerations

- Special challenges:
  - Narrow external canal
  - More aggressive disease
  - Higher recurrence rates
  - Eustachian tube dysfunction
  - Growing temporal bone
- Surgical timing:
  - 7-10 years for elective cases
  - Earlier for complications/aggressive disease
  - Balance between hearing and disease control
- Technical modifications:
  - Preference for cartilage grafts
  - Lower threshold for staged procedures
  - Consideration of long-term outcomes
  - Emphasis on hearing preservation

Hearing Rehabilitation Options

- Conventional options:
  - Air conduction hearing aids
  - Bone conduction devices
  - CROS/BiCROS systems
- Implantable options:
  - Bone-anchored hearing devices
  - Active middle ear implants
  - Cochlear implants (for severe SNHL)
- Selection factors:
  - Degree and type of hearing loss
  - Status of external/middle ear
  - Patient preference and expectations
  - Cost and availability
  - Need for additional surgery

Future Directions

- Tissue engineering approaches:
  - TM regeneration
  - Bioactive scaffolds
  - Stem cell applications
  - Growth factor delivery
- Technological advances:
  - Robotic middle ear surgery
  - Virtual reality surgical planning
  - Navigation-guided surgery
  - Artificial intelligence for disease mapping
- Novel biomaterials:
  - Smart materials with antibiotic properties
  - Bioresorbable ossicular prostheses
  - 3D bioprinting
  - Drug-eluting implants

Key Principles in CSOM Surgery

- Individualized approach based on:
  - Disease type and extent
  - Patient factors
  - Anatomical considerations
  - Hearing status
- Balance between:
  - Disease eradication vs. hearing preservation
  - Single-stage vs. staged procedures
  - Cavity creation vs. maintenance issues
- Comprehensive management:
  - Preoperative optimization
  - Meticulous surgical technique
  - Appropriate postoperative care
  - Long-term follow-up

Key References

1. Neeff M, et al. Canal wall down mastoidectomy: A long term commitment to the outpatients? Int J Pediatr Otorhinolaryngol. 2016;91:25-29.
2. Tarabichi M, et al. Endoscopic management of chronic otitis media and tympanoplasty. Otolaryngol Clin North Am. 2013;46(2):233-251.
3. Mohanty S, et al. A comparative study of endoscopic versus conventional canal wall up mastoidectomy. Indian J Otolaryngol Head Neck Surg. 2020;72(4):524-532.
4. Dornhoffer JL, et al. Cartilage tympanoplasty: the learning curve. Laryngoscope. 2003;113(11):1910-1913.
5. Prasad SC, et al. Current trends in the management of the complications of chronic otitis media with cholesteatoma. Curr Opin Otolaryngol Head Neck Surg. 2013;21(5):446-454.
6. Yung M, et al. EAONO/JOS Joint Consensus Statements on the Definitions, Classification and Staging of Middle Ear Cholesteatoma. J Int Adv Otol. 2017;13(1):1-8.
7. Brito R, et al. Titanium versus titanium-polyethylene ossicular chain reconstruction prosthesis: a systematic review and meta-analysis. Eur Arch Otorhinolaryngol. 2017;274(11):3795-3804.
8. Semaan MT, Megerian CA. The pathophysiology of cholesteatoma. Otolaryngol Clin North Am. 2006;39(6):1143-1159.

Conclusions

- CSOM remains a significant global health burden
- Comprehensive understanding of pathophysiology guides management
- Individualized treatment approach based on disease type and extent
- Medical management effective for uncomplicated cases
- Surgical intervention indicated for persistent disease or complications
- Technological advances improving diagnostic and therapeutic outcomes
- Multidisciplinary approach essential for optimal management
- Preventive strategies critical in reducing disease burden

Key References

1. Mittal R, et al. Current concepts in the pathogenesis and treatment of chronic suppurative otitis media. J Med Microbiol. 2015;64(10):1103-1116.
2. Monasta L, et al. Burden of disease caused by otitis media: systematic review and global estimates. PLoS One. 2012;7(4):e36226.
3. Chowdhury MA, Alauddin M. Comparative study between tubotympanic and atticoantral types of chronic suppurative otitis media. Bangladesh Med Res Counc Bull. 2002;28(1):36-44.
4. Yorgancilar E, et al. Complications of chronic suppurative otitis media: a retrospective review. Eur Arch Otorhinolaryngol. 2013;270(1):69-76.
5. Mostafa BE, et al. Evaluation of bacterial biofilm in chronic suppurative otitis media. Eur Arch Otorhinolaryngol. 2018;275(1):101-106.
6. Harris AT, et al. Evolution of tympanoplasty for chronic suppurative otitis media: a systematic review. J Laryngol Otol. 2016;130(S3):S66-S71.
7. Prasad SC, et al. Current trends in the management of the complications of chronic otitis media with cholesteatoma. Curr Opin Otolaryngol Head Neck Surg. 2013;21(5):446-454.
8. Basavaraj S, et al. Totally endoscopic repair of attic perforation. Otolaryngol Clin North Am. 2013;46(5):745-752.

Thank You

Questions?

Prof. Dr. Santhosh Kumar Rajamani
Department of Otorhinolaryngology