Chapter 25: Endoscopic Middle Ear Surgery

Introduction

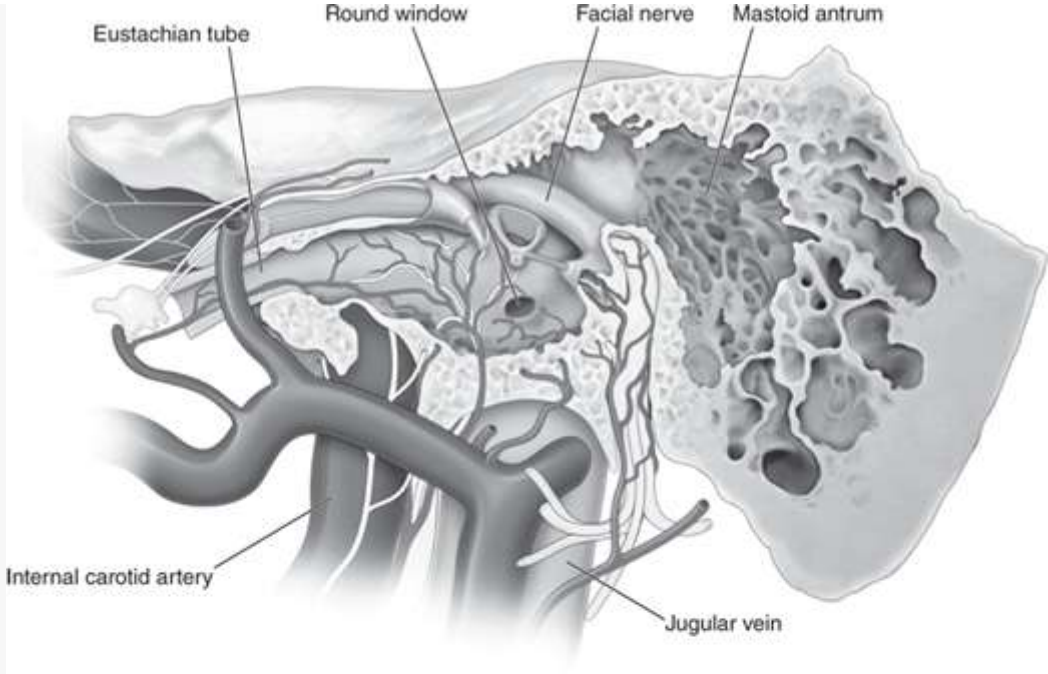
Endoscopic ear surgery (EES) is a minimally invasive approach similar to standard microscopic techniques. Initially endoscope was used to assist traditional operations to visualize middle ear hidden areas. Therefore, instrumentals, optics, light and camera systems improvements allowed endoscope to be a main tool in middle ear surgery.

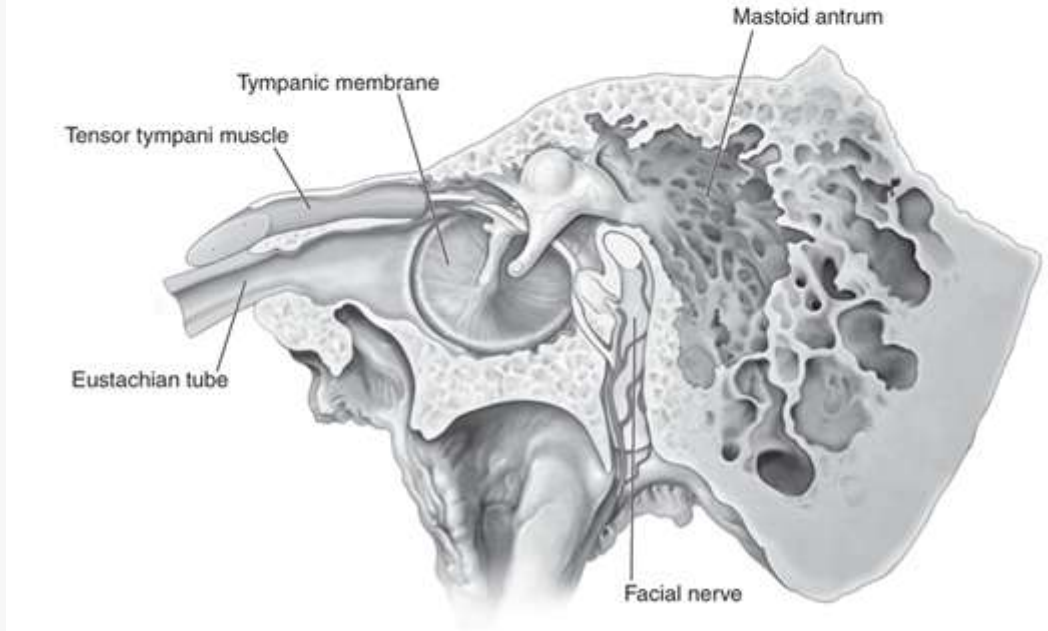
Anatomy

Middle ear is an irregular cavity filled with air in the center of the temporal bone in tympanic portion (Figure 25-1).

FIGURE 25-1

Schematic view of the middle ear anatomy and its limits. et: Eustachian tube; fn: facial nerve; ica: internal carotid artery; ju: jugular vein; ma: mastoid antrum; rw: round window; tm: tympanic membrane; ttm: tensor tympani muscle.





Limits

- Superior: called tegmen, a plate of bone below middle cranial fossa dura and temporal lobe.

- Inferior: narrow and thin plate of bone above jugular bulb. Careful approach to middle ear is necessary if patient has a high or dehiscent jugular bulb.
- Medial: cochlear promontory (cochlea basal turn), tympanic plexus (Jacobson nerve), oval and round windows, tympanic segment of facial nerve, and lateral semicircular canal.
- Lateral: tympanic membrane, annulus fibrosus, and scutum.
- Anterior: formed by petrous bone. From superior to inferior:
    a. Tensor tympani muscle canal
    b. Eustachian tube
    c. Internal carotid artery (vertical segment)
- Posterior: formed by the petrous bone and *aditus ad antrum* that communicates attic and mastoid antrum.

Epitympanum (Attic)

- It is the upper portion of middle ear cavity above tympanic membrane level and an imaginary plane through malleus short process (Figures 25-2, 25-3, and 25-4).
- Communicates with mastoid antrum.
- Plays a fundamental role in ventilation routes.
- Limits:
    a. Superior: tegmen tympani
    b. Inferior: tympanic diaphragm and isthmus

    c. Medial: facial nerve canal and lateral semicircular canal
    d. Lateral: pars flaccida of tympanic membrane and scutum (Chaussé spur)
    e. Anterior: zygomatic root
    f. Posterior: incudal fossa and aditus ad antrum
- Posterior epitympanum compartment is posterior to superior malleal fold:
    a. Posterior part of malleus head
    b. Incus body and short process
    c. Posterior route ventilation: most important pathway to attic
- Anterior epitympanum compartment is anterior to superior malleal fold:
    a. Anterior portion of malleus head
    b. Anterior route of ventilation: accessory pathway to attic
- Tympanic diaphragm is made of various folds and ligaments:
    a. Posterior incudal ligament
    b. Lateral incudomalleal fold
    c. Lateral malleal fold
    d. Lateral malleal ligament
    e. Anterior malleal fold
    f. Anterior malleal ligament
    g. Tensor tympani fold (or posterior malleal fold)

h. Tensor tympani muscle tendon

- Tympanic isthmus is a 2.5-mm opening in the tympanic diaphragm that ventilates entire attic.

    a. Anterior tympanic isthmus: between incudostapedial joint and tensor tympanic muscle tendon. It is the largest and most important ventilation route to attic. Granulation tissues and web blockages at this region lead to attic selective dysventilation, chronic edema, exudate, inflammation, infections, retraction pockets, and cholesteatoma.
    b. Posterior tympanic isthmus: posterior to incudostapedial joint, between stapedial muscle tendon, pyramidal eminence, and ...

Chapter 29: Chronic Rhinosinusitis

Classification and Diagnosis

A. Chronic rhinosinusitis (CRS) is defined as symptomatic inflammation of the paranasal sinuses and nasal cavity for a duration longer than 12 weeks.
    i. To make a diagnosis of CRS, two or more of the following cardinal symptoms must be present for 12 weeks or longer:
        a. Mucopurulent drainage (anterior or posterior)

b. Nasal obstruction/congestion
c. Facial pain or pressure
d. Hyposmia or anosmia

ii. In addition to documentation of two or more of the above symptoms, inflammation of the nasal mucosa must be confirmed by one of the following findings:

a. Polyps in the nasal cavity or middle meatus, confirmed with endoscopy or anterior rhinoscopy
b. Purulence or edema in the middle meatus or anterior ethmoid cavity
c. Radiographic (CT) evidence of mucosal thickening, edema, or other findings consistent with inflammation

B. CRS can be punctuated by acute exacerbations, sometimes referred to as “acute-on-chronic” rhinosinusitis, in which symptoms worsen secondary to an acute infection or other environmental insult.
C. Subacute rhinosinusitis historically referred to symptoms lasting between 4 and 12 weeks, although recent guidelines have only made diagnostic and treatment distinctions between acute and CRS.
D. Recurrent acute sinusitis refers to four or more discrete episodes of sinusitis in one year, with

asymptomatic periods between episodes, and is treated differently from CRS.

Subtypes

A. Overall prevalence (all types) ranges from 4.5% to 12.5% in Western populations.
B. There are generally three subtypes of CRS recognized:
    i. CRS with nasal polyposis (CRSwNP): 20% to 33%
        a. Excessive TH-2 inflammation, eosinophilic infiltration, histamine, IL-5, IL-13
    ii. CRS without nasal polyposis (CRSsNP): 60% to 65%
        a. Neutrophilic infiltration, IL-1, IL-16, tumor necrosis factor α (TNF-α)
        b. Can be due to primary/acquired mucociliary failure, immunodeficiency, or anatomic factors
    iii. Allergic fungal rhinosinusitis (AFS): 8% to 12%
C. In practice, there can be overlap of several of the above inflammatory markers and etiologies in both CRSwNP and CRSsNP.
D. New research is ongoing to further classify CRS based on microscopic, genomic, and microbiomic categorizations.

Pathogenesis

A. There are several factors which are thought to contribute to the development of chronic sinusitis. Many of these can overlap, making a targeted diagnosis and treatment plan difficult to develop.
B. Multiple episodes of acute rhinosinusitis (ARS) (predominately infectious process) may ultimately lead to the development of chronic sinusitis (predominately inflammatory process).
    i. Whereas ARS is marked by a suppurative, neutrophil-predominate infectious etiology, CRS is characterized by an inflammatory response where eosinophils are the predominant inflammatory cells in both atopic and nonatopic individuals.
C. Contributing factors to CRS include anatomy, local physiologic factors, and systemic physiologic factors.
D. Anatomic factors
    i. Blockage of the osteomeatal complex, sphenoethmoidal recess, frontal recess, or other natural drainage pathways by anatomic abnormalities can cause or prolong chronic sinusitis.
        a. Septal deviation, turbinate hypertrophy, middle turbinate concha bullosa, paradoxical turbinates, prominent agger nasi cell, Haller cells, prominent ethmoid

bulla, pneumatization and inversion of uncinate process, hypoplastic sinuses, accessory maxillary ostia → recirculation

E. Local physiologic factors
    i. **Mucociliary impairment:** Ciliary function plays an important role in the clearance of sinuses……..

Chapter 32: Tumors of the Paranasal Sinuses

Paranasal and Anterior Skull Base Anatomy

- The paranasal sinuses develop from mesenchymal and ectodermal tissue.
- The sinuses define the spaces for tumor development and bony margins are barriers for spread to adjacent tissue.

Margins for Tumor Spread	Anatomic Route
Anterior	Frontal sinus and septum
Superior lateral	Orbits and supraorbital dura
Inferior lateral	Pterygopalatine fossa

Posterior lateral	Fossa of Rosenmuller
Inferior posterior midline	Clivus and arch of C1
Superior posterior midline	Sella
Superior	Cribriform plate

- The numerous foramina in the ventral skull base host critical neurovascular structures and allow direct tumor spread.

Paranasal Sinus Neoplasm Epidemiology

- Paranasal neoplasms vary from benign congenital malformations to high-grade malignancies.
- Squamous cell cancer (SCC) is the most common malignancy occurring with a frequency of 1:200,000 per year in the United States.
- Paranasal malignancies comprise less than 1% of all cancers and 3% of cancers of the upper aerodigestive tract.
- 55% of cancers in the paranasal sinuses originate in the maxillary sinus, 35% in the nasal passage, and 10% in the ethmoids.
- Tumors of the frontal and sphenoid sinus account for less than 1% of paranasal malignancies.

History and Presentation

- Paranasal tumors are a diagnostic and therapeutic challenge because they initially mimic common inflammatory sinonasal disease leading to delayed diagnosis and higher stages at diagnosis.
- Most common symptom: nasal obstruction.
- Second most common symptom: neck lymphadenopathy.
- Nasal: discharge, congestion, epistaxis, disturbance of smell.
- Facial: infraorbital nerve hypoesthesia, pain.
- Ocular: unilateral epiphoria, diplopia, fullness of lids, pain, vision loss.
- Auditory: aural fullness, otalgia, hearing loss.
- Oral: pain involving the maxillary dentition.
- Constitutional symptoms: fever, malaise/fatigue, weight loss.

Associated Causative Factors

- Squamous cell carcinoma (SCC): nickel, aflatoxin, chromium, mustard gas, volatile hydrocarbons, and organic fibers that are found in the wood, shoe, and textile industries
- Adenocarcinoma: wood dust, woodworking, furniture making, leather work

- Human papilloma virus (HPV) may be a cofactor in some tumors; however, this finding may be an association and not a cause and effect situation.
    a. Tumor suppressor protein inhibition by viral E6 and E7 proteins has not been well studied in paranasal sinus tumors.

Physical Examination

- Head/face: midface/periorbital edema
- Eye: proptosis, visual field deficits, extraocular motion restriction, fullness of eyelids, chemosis, ptosis
- Ear: middle ear effusion (often unilateral)
- Nose: nasal cavity mass
- Oral cavity: loose dentition, palatal sensory asymmetry, trismus, malocclusion, erosion of mass into the oral cavity
- Neurologic: cranial nerve (CN) deficits, which commonly include CN I, II, III, IV, V1, V2, VI

Diagnostic Nasal Endoscopy

- Evaluate extent of tumor and attempt to determine the origin or base.
- Perform Valsalva maneuver under direct visualization—expansion implies intracranial or major venous extension.
- Evaluate for ease and safety of biopsy.

Chapter 53: Pediatric Otolaryngology

General Information

This chapter focuses on otolaryngologic issues in children. The chapter is divided into (1) ears and hearing; (2) nose, nashopharynx, and paranasal sinuses; (3) mouth and upper digestive tract; (4) airway; and (5) head and neck.

Ears and Hearing

Outer Ear (Pinna, External Auditory Canal [EAC], Tympanic Membrane[TM])

Developmental Anatomy

A. Prenatal development
    i. 5 weeks' gestation
        a. Auricle develops from first (mandibular) and second (hyoid) arches that give rise to six Hillocks of His.
        b. Controversial, but first Hillock gives rise to tragus, second to helical crus, third to remainder of helix, fourth to antihelix, fifth to antitragus, sixth to lobule. Lobule is last to form and some feel not derived from Hillocks.
    ii. 8 weeks' gestation
        a. Cartilaginous (outer third) of EAC derived from invagination of concha cavum (first branchial groove).

b. Bony EAC (inner two-thirds) derived from invagination of meatal plug (solid epithelial core) from primary meatus to primitive tympanic cavity to form meatal plate.

iii. 21 weeks' gestation

a. Epithelial cells resorb to canalize bony EAC. Incomplete resorption results in atresia or stenosis.
b. Tympanic membrane has three layers.
    1. Outer epithelial layer from ectoderm of first branchial groove.
    2. Middle fibrous layer.
    3. Inner mucosal layer from endoderm of first pharyngeal pouch.
    4. Pars tensa composed of three layers. Pars flaccida composed of two (outer and inner) layers. Perforations in pars tensa that heal and look thin are composed of outer and inner layers (missing middle layer) and should be called dimeric membrane (rather than monomeric membrane which is a misnomer).

B. Postnatal development

i. Medial EAC ossifies by 2 years of age and reaches adult size by 9 years of age.

ii. TM almost adult size at birth but horizontally oriented. Becomes more vertical as EAC lengthens.
iii. Pinna is 80% of adult size by age 5, adult size by age 9. Lobule may continue to grow thereafter.

Signs and Symptoms

Visible lesion, drainage, infection, abnormally shaped pinna.

Clinical Assessment

Close inspection of pinna and remainder of head and neck for associated features as described below.

Pathologies

Congenital

A. Preauricular tag
    i. Most common ear anomaly.
    ii. Due to supernumerary hillock formation.
    iii. May be associated with branchio-oto-renal (BOR) syndrome involving hearing loss, branchial cleft cyst, and renal anomalies or other craniofacial syndromes.
    iv. May be removed electively.
B. Preauricular pit
    i. Likely due to failure of fusion of hillocks.

ii. Most commonly at helical root. Pit below tragus more likely to be first branchial cleft anomaly.
iii. May be associated with BOR.
iv. Acute infection warrants antibiotics and drainage if necessary.
v. Definitive excision after resolution of inflammation. Removal of entire tract plus cartilage at base of tract is necessary to prevent postoperative infection and recurrence.

C. Protruding ears
i. Larger than average distance from helical rim to mastoid.
ii. Usually bilateral.
iii. Due to under development of antihelix and deep conchal bowl.
iv. Elective otoplasty at 5 ...