

EDITORIAL

THE MUCOSA OF THE TYMPANIC CAVITY AND MIDDLE EAR SPACES

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The middle ear mucosa is to some degree a respiratory mucosa carrying cilia in its surface and being able to secrete mucus (Sade 1966). The extent of the mucociliary epithelium varies in normal middle ears, being more widespread in the young. However three distinct mucociliary tracts or pathways can be identified-epitympanic, promontorial and hypotympanic, the latter being the largest. Each of these pathways coalesces at the tympanic orifice of the Eustachian tube¹ (Gleeson, Felix and Neivergelt 1991).

Mucus comes from goblet cells and from mucus glands which are collections of mucus producing cells linked to a surface by a short duct. In the middle the glands are sometimes absent: however, in most ears they are present and tend to be clustered around the orifice of the Eustachian tube. Goblet cells eject mucus directly into the middle ear space and are in highest concentration close to the Eustachian tube opening² (Tos and Bak Pederson 1976). Again, large numbers of goblet cells are rarely seen, but their presence is indicative of the potential ability of the middle ear mucosa to undergo changes typical of respiratory epithelium³.

The predominant cell type varies with location in the tympanomastoid compartment. Ciliated cells intermingle with secretory cells on the promontory, in the hypo tympanum, and in the epitympanum⁴; the mucociliary tract thus formed act in concert with mucociliary clearance system of the Eustachian tube⁴.

The tympanic cavity is lined with mucous membrane, which covers its walls and all exposed contents. This lining is continuous anteriorly with the mucosa of the auditory tube and posteriorly with that of the mastoid antrum and mastoid air cells. Recent studies have shown that part of the mucosa is covered with cilia, which are supported in some areas by columnar pseudo stratified cells and in other areas by low columnar epithelium. These ciliary tracts appear related to the clearance function of the middle ear. The tympanic mucosa is pale, thin and slightly vascular, it is ciliated columnar epithelium but in posterior part near ossicles is flatter and non ciliated epithelium is closely attached to periosteum⁵.

The mucus membrane lines the bony walls of the tympanic cavity, and it extends to cover the ossicles and their supporting ligaments in much the same way as peritoneum covers the viscera in the abdomen. To understand the complicated anatomy of mucosal folds of middle ear cleft one has to understand the development of tympanic cavity. The mucosa originate from the dorsal end of of the endoderm of first pharyngeal pouch, as it elongates, divides, proliferates forms the mucosal lining of tympanic cavity covering all the ossicles, ligaments and tendons. At three week stage an out pouching develops known as tubo-tympanic recess. At seven week second arch constricts dividing it into lateral as tympanic cavity and medial as primordial Eustachian tube.

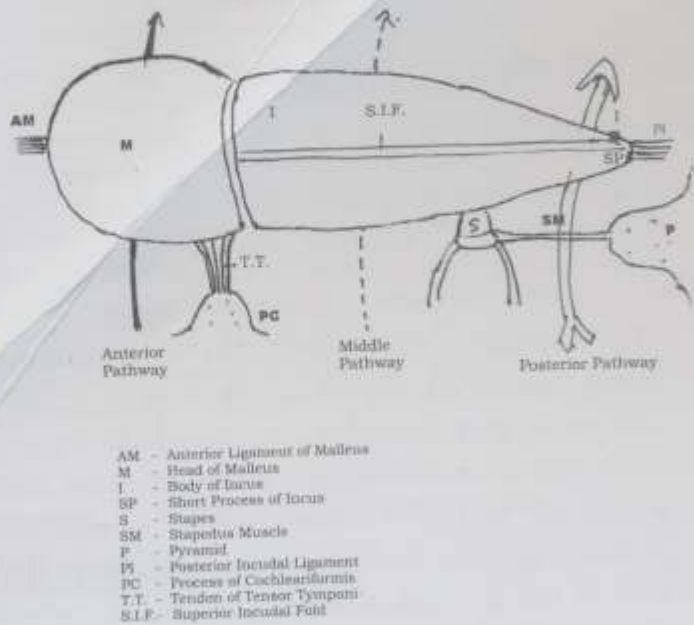


Fig. A : Attic Folds

The terminal end of this elongated tube divides into four pouches and these four on proliferation cover and line the tympanic cavity⁷. The Saccus Anticus forms the anterior pouch of Von Troeltsch, Saccus Medius forms the attic, Saccus superioris forms the posterior pouch of Von Troeltsch and the inferior incudal recess. It also pneumatize the squamous portion of temporal bone. Saccus posticus covers the round window, hypotympanic area and sinus tympani⁸.

MIDDLE EAR SPACES

The tympanic cavity is sagittally oriented slit that lies immediately medial to the tympanic membrane. Its roof or tegmen also serves as part of the floor of the middle cranial fossa, whereas posteriorly its irregularly contoured floor of tympanic cavity features the jugular bulb, the root of the styloid process and anteriorly internal carotid artery. The tympanic cavity is in continuity with the Eustachian tube anteriorly and with the mastoid air cells via the aditus and antrum posteriorly. It is traversed by the ossicular chain and is lined with a mucosal epithelium. Planes extended from the tympanic

annulus subdivide the tympanic cavity into mesotympanum, hypotympanum, protympanum, and posterior tympanic cavity. The epitympanum lies above the plane of the anterior and posterior tympanic spines⁹.

Anteriorly the mesotympanum is dominated by the bulge of the semicircular canal of the tensor tympani muscle; the tympanic orifice of the Eustachian tube is immediately inferior to this bulge. Posteriorly the key anatomic features are the pyramidal eminence and lateral to it the chordal eminence. The chordal eminence houses the chordae posterius by which the chorda tympani nerve enters the tympanic cavity⁹.

The medial wall (surgical floor of the middle ear) features three depressions: the sinus tympani, oval window niche, and round window niche. The sinus tympani is defined by the ponticulus superiorly, the subiculum inferiorly, the mastoid segment of the facial nerve laterally, and the posterior semicircular canal medially; there is substantial variability in the posterior extension

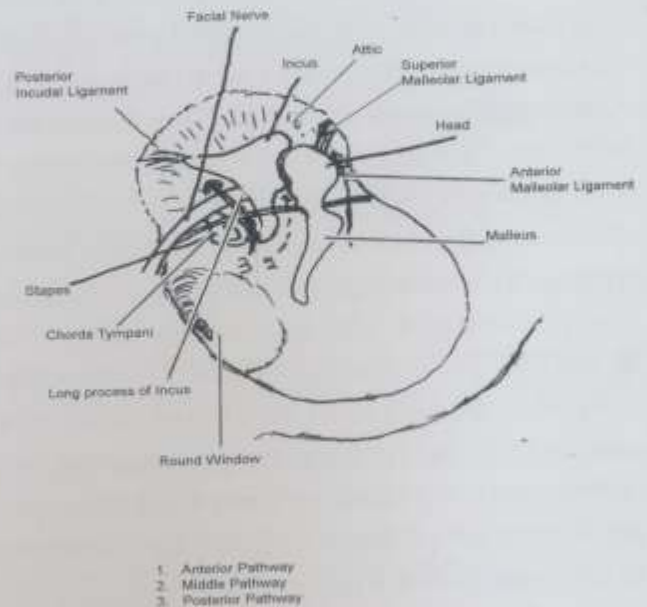


Fig. B : Air Pathways

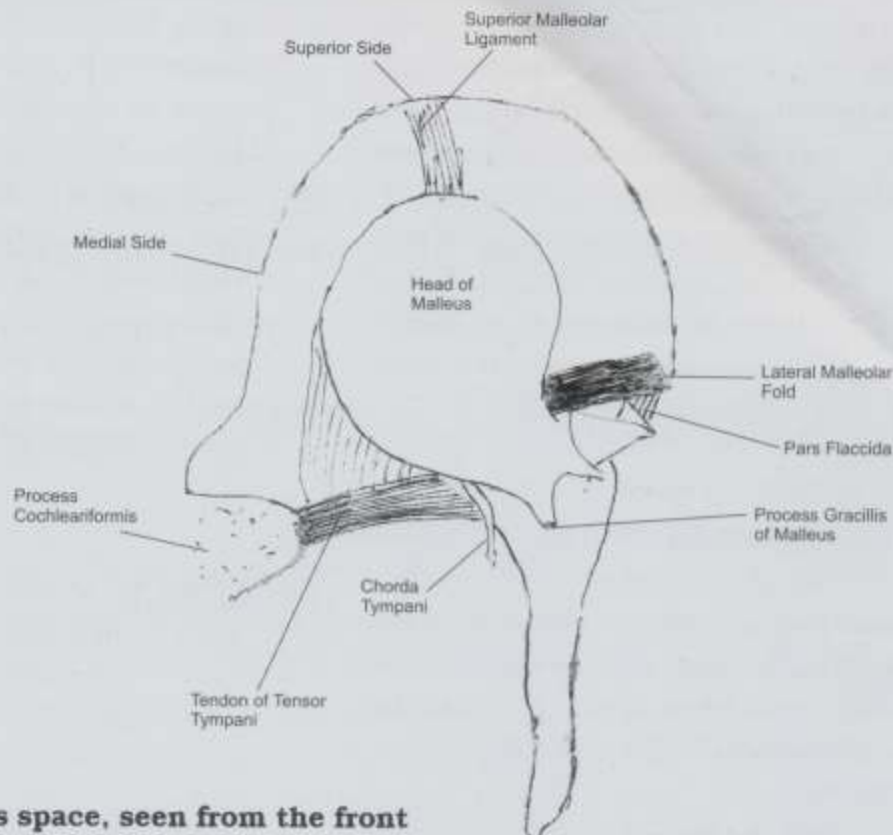


Fig. C : Prussak's space, seen from the front

(surgical depth) of the sinus tympani, ranging from shallow to deep. The oval window niche, occupied by the stapes footplate, is located anterosuperior to ponticulus. The round window niche can be found posteroinferior to the promontory, the bulge created by the basal turn of the cochlea.

The sinus tympani evade direct surgical visualization, which is particularly worrisome in cholesteatoma surgery as it can harbor the nidus of recurrence. Inspection of this region has been somewhat improved by the advent of the endoscopes appropriate for otologic surgery or learning how much one can drill safely anterior to facial nerve. The oval window niche may be the site of a perilymphatic fistula. Similarly, the round window niche may be implicated in perilymph leakage. In assessing the round window, it is important to realize that in vast majority of cases the true round window membrane is obscured by some kind of mucosal veil; most often, the veil is perforated, giving the false impression of seeing a defect in the round window membrane^{8,10}.

TYMPANIC SPACES

Prussak's pouch is a space triangular in vertical section. It is limited laterally by the pars flaccida, caudally by the short process of the malleus, and superiorly by the lateral malleolar fold, which passes from the neck of the malleus to the tympanic scutum. Attic retraction pockets and, occasionally, cholesteatomas are found in Prussak's pouch. In a normal aerated middle ear there are three preformed pathways which communicate the mesotympanum and epitympanum⁶.

Anteriorly there is natural perforation in the tensor tympani fold which is a mucous membrane fold extending between anterior malleolar ligament and tensor tympani tendon from notch of Rivinus to the head and neck of malleus also closely associated with chorda tympani nerve, termed as anterior pathway There are two more preexisting pathways of air entry into middle and posterior compartment, anterior and posterior to long process of incus. Anteriorly posterior aspect of tensor tympani tendon posteriorly stapes laterally posterior malleolar fold

medially horizontal segment of facial nerve forms the boundary of middle air way. The posterior malleolar fold envelops the posterior segment of chorda tympani nerve and extends from posterior notch of Rivinus to neck of malleus¹¹. The edema, inflammation granulations even glue may block these communications leading to irreversible changes in mucosa. It is worth remembering that granulation erode the bone much more than cholesteatoma¹².

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