Auris Nasus Larynx xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Auris Nasus Larynx

journal homepage: www.elsevier.com/locate/anl

Histopathology of tympanic membranes from patients with ventilation tubes

Mehmet Faruk Oktay [a,b], Hasan Deniz Tansuker [a], Hisaki Fukushima [b], Michael M. Paparella [c], Patricia A. Schachern [b], Sebahattin Cureoglu [b,*]

[a] Department of Otolaryngology, University of Health Sciences Bagcilar Training and Research Hospital, Istanbul, Turkey
[b] Department of Otolaryngology, University of Minnesota, Minneapolis, MN, United States
[c] Paparella Ear Head and Neck Institut, Minneapolis, MN, United States

ARTICLE INFO

Article history:
Received 20 December 2016
Accepted 13 July 2017
Available online xxx

Keywords:
Temporal bone
Histopathology
Ventilation tube

ABSTRACT

Objective: To evaluate the histopathologic changes in tympanic membranes (TMs) with ventilation tubes (VTs).

Methods: In this retrospective human temporal bone study our overall study group included 4 subgroups of TMs from deceased donors as follows: 24 with a history of VT insertion for chronic otitis media with effusion (COME-VT); 5 with a history of VT insertion for Meniere's disease (MD-VT); 33 without a history of VT insertion for chronic otitis media with effusion (COME); and 14 without a history of VT insertion for Meniere's disease (MD). We classified the extent of migration of the outer keratinized squamous epithelium onto the inner surface of TM perforations and noted the presence and location of tympanosclerosis, of atrophy, of perforation, and/or of cholesteatoma formation.

Results: Tympanosclerosis occurred in 14/24 TMs in the COME-VT subgroup; 2/5, MD-VT; 7/33, COME; and 0/14, MD. The VT insertion site was mostly in the anteroinferior (63%) quadrant of the TM; tympanosclerosis occurred more frequently in the posteroinferior (42%) and posterosuperior (33%) quadrants. We found no significant correlation between the location of tympanosclerosis and the VT insertion site ($P > 0.05$). Atrophy occurred in 7/24 TMs in the COME-VT subgroup; 3/5, MD-VT; 8/33, COME; and 2/14, MD. We found no significant correlation between the location of atrophy and the VT insertion site; however, atrophy was located mostly in the anteroinferior quadrant (one of the most common VT insertion sites) of the TM. Regarding the ingrowth of keratinized epithelium, the mucocutanous junction was detected at any point at the inner surface of the TM in 50% of the specimens. We observed intratympanic cholesteatoma formation in 2/24 TMs in the COME-VT subgroup.

Conclusion: TM changes due to VT insertion are more common than previously realized. Meticulous otomicroscopic evaluation of the TM is necessary during tympanomastoidectomies in order to prevent the intratympanic inclusion pearls and squamous epithelial ingrowth to prevent any further cholesteatoma formation.

* Corresponding author at: Otopathology Laboratory Department of Otolaryngology, University of Minnesota Physicians (UMP), University of Minnesota, Lions Research Building: 2001 6th Street SE, Minneapolis, MN 55455, United States.
E-mail address: cureo003@umn.edu (S. Cureoglu).

http://dx.doi.org/10.1016/j.anl.2017.07.017
0385-8146/

1. Introduction

Ventilation tube (VT) insertion in the ear is one of the most common surgical procedures in the USA [1]. VTs are safe and efficacious for patients with chronic otitis media with effusion (COME), but can be associated with sequelae in the tympanic membrane (TM), such as persistent perforation, tympanosclerosis, atrophy, and cholesteatoma formation [2–4]. Yet those same sequelae can also occur because of COME, so it is therefore, difficult to distinguish between the effect of the disease itself and the effect of VT insertion [5]. Some clinical studies, however, have demonstrated that ears treated with VTs are more prone to pathologic changes in the TM than ears without VTs [5–7].

In this study, we evaluated the TM changes in temporal bones from deceased donors with (vs. without) a history of VT insertion for COME or for Meniere's disease (MD). To our knowledge, this is the first histopathologic study of TM changes in a series of temporal bones from donors with vs. without a history of VT insertion.

2. Materials and methods

Our study groups included 4 subgroups of TMs from deceased donors as follows: 24 TMs from 16 donors (age ranged from 18 months 72 years; mean 47 ± 17 years) with a history of VT insertion for COME (the COME-VT subgroup); 5 TMs from 5 donors (mean 57 ± 13 years)

with a history of VT insertion for MD, after endolymphatic sac enhancement surgery (the MD-VT subgroup); 33 TMs from 24 donors (mean: 60.5 ± 21) without a history of VT insertion for COME (the COME subgroup); and 14 TMs from 13 donors (mean: 63.5 ± 15.06) without a history of VT insertion for MD (the MD subgroup).

In the COME-VT subgroup, the TM was intact in 10 and perforated in 14 out of the 24 temporal bones. We classified the extent of migration of the outer stratified squamous epithelium as follows: type I, the mucocutaneous junction ended at the outer surface of the perforation; type II, the mucocutaneous junction reached the inner surface; or type III, the mucocutaneous junction was detected at any point within the inner surface. We recorded the maximum distance of ingrowth of stratified squamous epithelium on the inner surface of TM perforations.

To determine the VT insertion site, we reviewed each deceased donor's chart. We noted the presence and location of tympanosclerosis, of atrophy, of perforation, and/or of presence and location of cholesteatoma formation in the TM, as well as the thickness of the TM. To distinguish between the effect of the disease itself and the effect of VT insertion, we used the Fisher exact test to compare the 4 subgroups.

3. Results

The prevalence of atrophy and tympanosclerosis varied among the 4 subgroups (Table 1).

Table 1
The extension of atrophy of the tympanic membrane in cases treated with VTs and without VTs.

Atrophy	1 Quadrant	2 Quadrants	3 Quadrants	4 Quadrants
COME-VT	4	3	–	–
COME	1	2	4	1
MD-VT	3	–	–	–
MD	1	1		

3.1. COME-VT subgroup

Of the 24 TMs in this subgroup, the VT insertion site was in the anteroinferior quadrant in 15 (63%); posteroinferior, 5 (21%); anterosuperior, 2 (8%); and unknown, 2 (8%).

A total of 14 of these 24 TMs were perforated. The perforation site was in the anteroinferior quadrant in 8 (57%); posteroinferior, 5 (36%); and anterosuperior, 1 (7%). The perforation size ranged from 0.7 mm to 2.2 mm (mean, 1.3 mm). We classified the ingrowth of stratified squamous epithelium at the perforation edges of the TMs as type I in 7 (50%); type II, 3 (21%); and type III, 4 (29%). In the type III cases (Fig. 1), the mean ingrowth was 1.16 mm (maximum, 1.96 mm). We observed intratympanic cholesteatoma formation in 2 (8%) of the TMs (Figs. 1 and 2); papillary projections of squamous epithelium, in 3 (12%) (Fig. 3).

Of the 24 TMs, tympanosclerosis occurred in 14 (58%). It was located in all 4 quadrants in 1 of the TMs; 3 quadrants, in 2; 2 quadrants, in 5; and 1 quadrant, in 6 (Fig. 4). The posteroinferior quadrant was the most common location of tympanosclerosis, which occurred there in 10 (42%) of the 24 TMs. Tympanosclerosis occurred in the posterosuperior quadrant in 8 (33%); anteroinferior, 5 (21%); and anterosuperior, 3 (13%). We found no significant correlation between the location of tympanosclerosis and the VT insertion site ($P > 0.05$).

Of the 24 TMs, 7 (29%) were atrophic. Of these 7 TMs, 2 consisted of only epithelium and mucosa, with no middle fibrous layer. But in the other 5, we noted thinning, with degeneration of the middle fibrous layer. Atrophy occurred in the anteroinferior quadrant in 5; posteroinferior, 3; and anterosuperior, 2 (note: in 3 of these TMs, atrophy occurred in more than 1 quadrant). We found no significant correlation between the location of atrophy and the VT insertion site ($P > 0.05$); however, atrophy occurred mostly in the anteroinferior quadrant, which was the most common VT insertion site.

3.2. MD-VT subgroup

In all 5 of the TMs in this subgroup, the VT insertion site was in the anteroinferior quadrant. All 5 TMs were intact. Tympanosclerosis occurred in 2 (40%). In 1 of those TMs, it was located in the posterosuperior quadrant; in the other, in both the posterosuperior and posteroinferior quadrants.

Atrophy occurred in 3 (60%) of these TMs: in the anteroinferior quadrant in all 3 (in contrast to tympanosclerosis,

Please cite this article in press as: Oktay MF, et al. Histopathology of tympanic membranes from patients with ventilation tubes. Auris Nasus Larynx (2017), http://dx.doi.org/10.1016/j.anl.2017.07.017