Effect of the Ear Microbiome on Tympanoplasty Healing

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BACKGROUND

- Tissue microbiome has been implicated as the primary factor in the pathogenesis of chronic non-healing wounds.
- Chronic tympanic membrane perforations are chronic non-healing wounds.
- Microbial burden with pathogens such as *Pseudomonas aeruginosa* and *Staphylococcus aureus* has long been linked to wound surgical treatment failure.
- Chronic tympanic membrane perforations are commonly contaminated with *P. aeruginosa* and *S. aureus*.
- The reported tympanoplasty failure rates are as high as 35%, and other adverse healing outcomes may be even more common.
- This study aimed to analyze if the presence of *S. aureus* or *P. aeruginosa* in the ear affect tympanoplasty healing.

METHODS

- University of Florida Institutional Review Board approval, IRB201701314
- All patients undergoing a tympanoplasty for tympanic membrane (TM) perforation at our institution between June 2017 and October 2017 were eligible for enrollment.
- Patients with cholesteatoma were excluded.
- 23 patients were enrolled, from which an ear canal swab, middle ear swab, and TM tissue sample were obtained.
- Samples were cultured for *S. aureus* and *P. aeruginosa*.
- Data on tympanoplasty healing at patient's 2-6 week, 2-6 month, and 1-2 year follow up appointments were gathered from the electronic medical record.
- 22, 20 and 11 patients attended the 2-6 week, 2-6 month, and 1-2 year follow up, respectively.
- Chi-square, Fisher's or Student's t-test were used as appropriate. P-value < 0.05 was considered significant.

RESULTS

Table 1. Study cohort

Variable	Subjects (n = 23)
Female	14
Mean age, years	35.8 (5 - 83)
Race	
White	13
Black	1
Hispanic	2
Other	3
Not specified	4
Left ear	16
Diabetes mellitus	2
Hypothyroidism	2
Head & neck radiation	1
Obesity	3
Smoker, active	2
Autoimmune disease	2
Malnutrition	0
Immunodeficiency	2

Range reported in parentheses.

Table 2. Operative data

Variable	Study Cohort (n = 23)
Mean case duration, minutes	104.1 (54 - 163)
Approach	
Postauricular	18
Endaural	5
Perforation Size	
≤ 25%	11
26-50%	7
51-75%	1
> 75%	4
Tympanic Membrane Graft	
Cartilage	2
Temporalis Fascia	17
Fibrofatty Tissue	4
Ossicular Chain Reconstruction	6
Bony Canalplasty	15
Mastoidectomy	2
Meatoplasty	12

Range reported in parentheses.

Table 3. Tympanoplasty healing in presence of *S. aureus*

Variable	*S. aureus* present	*S. aureus* absent	p value
TM perforation			
2-6 weeks	0/5	0/17	-----
2-6 months	3/5	2/15	**0.037**
1-2 years	2/3	0/8	**0.011**
Granulation tissue			
2-6 weeks	1/5	2/17	0.637
2-6 months	2/5	0/15	**0.01**
1-2 years	3/3	1/8	**0.007**
Otorrhea			
2-6 weeks	0/5	0/17	-----
2-6 months	0/5	1/15	0.554
1-2 years	1/3	1/8	0.571
Word recognition score			
Pre-op	97.6 % (14.8)	92.7% (3.6)	0.475
2-6 months	94.0 % (12.0)	89.43 (17.8)	0.639
1-2 years	100 % (0.0)	90.4 (7.8)	0.085

Values reported as prevalence of target variable/total sample of interest. Standard deviation reported in parentheses.

Table 2. Tympanoplasty healing in presence of *P. aeruginosa*

Variable	*P. aeruginosa* present	*P. aeruginosa* absent	p value
TM perforation			
2-6 weeks	0/4	0/18	-----
2-6 months	0/2	5/18	0.389
1-2 years	0/2	2/9	0.461
Granulation tissue			
2-6 weeks	1/4	2/18	0.464
2-6 months	1/2	1/18	0.195
1-2 years	1/2	3/9	0.658
Otorrhea			
2-6 weeks	0/4	0/18	-----
2-6 months	0/2	1/18	0.732
1-2 years	0/2	2/9	0.461
Word recognition score			
Pre-op	99.0 % (2.0)	92.6 % (14.4)	0.395
2-6 months	86.0 % (14.1)	91.0 % (17.1)	0.707
1-2 years	96.0 % (0.0)	93.7 % (8.3)	0.805

Values reported as prevalence of target variable/total sample of interest. Standard deviation reported in parentheses.

CONCLUSIONS

- Colonization of the TM, adjacent canal, and middle ear with *S. aureus* may lead to suboptimal tympanoplasty healing, including persistent perforation and persistent granulation tissue.
- Colonization of the TM, adjacent canal, and middle ear with *P. aeruginosa* did not appear to impact healing outcomes.
- Preoperative management of the ear microbiome holds the potential to improve tympanoplasty healing outcomes.

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