



Cerumen in Tinnitus Patients

Mustafa MWM^{1*}, Taya UK² and Ali A³

¹Professor of Audiovestibular Medicine, Otorhinolaryngology Department, Qena Faculty of Medicine, South Valley University, Qena, Egypt

²Associate Professor of Otorhinolaryngology, Otorhinolaryngology Department, Qena Faculty of Medicine, South Valley University, Qena, Egypt

³Lecturer of Audiovestibular Medicine, Otorhinolaryngology Department, Qena Faculty of Medicine, South Valley University, Qena, Egypt

***Corresponding Author:** Mustafa MWM, Professor of Audiovestibular Medicine, Otorhinolaryngology Department, Qena Faculty of Medicine, South Valley University, Qena, Egypt.

Received: August 15, 2024

Published: September 28, 2024

© All rights are reserved by **Mustafa MWM., et al.**

Abstract

Background: Tinnitus is a condition characterized by the perception of sound in the absence of an external stimulus, often manifesting as ringing, buzzing, or hissing noises. This study aimed to investigate whether tinnitus is associated with changes in cerumen (earwax) characteristics among patients.

Method: A total of 289 tinnitus patients were included in the analysis who answered a questionnaire designed for this research.

Results: Significant changes in cerumen properties in some patients. The amount of earwax increased in 20.1% and decreased in 5.9% of patients, while 74.0% reported no change. Notable changes were observed in earwax consistency, with 18.0% experiencing harder earwax and 14.2% experiencing drier earwax. About a quarter of the participants reported color changes, either darker (13.1%) or lighter (12.8%). Changes in the frequency of earwax buildup were noted, with 23.2% experiencing more frequent buildup and 16.6% experiencing less frequent buildup. Chi-square tests showed significant effects of tinnitus onset, duration, and severity on cerumen characteristics. Regression analysis indicated that the duration and severity of tinnitus significantly impacted earwax characteristics.

Conclusion: These findings suggest that tinnitus may influence earwax production and properties, potentially through altered autonomic regulation or changes in ear canal physiology. Understanding the relationship between tinnitus and cerumen changes is crucial for clinical management and further research is needed to explore underlying mechanisms.

Keywords: Tinnitus; Cerumen; Earwax; Ceruminous Changes; Auditory Health; Tinnitus Onset; Ear Canal Physiology; Cerumen Characteristics; Hearing Loss; Tinnitus Severity

Introduction

Cerumen, commonly referred to as earwax, is a natural substance present in the ear canal, composed of secretions from ceruminous and sebaceous glands, as well as shed epithelial cells. Its composition varies among individuals due to genetic and environmental factors [1].

The ceruminous glands secrete a complex mixture of lipids such as wax esters, squalene, and cholesterol, contributing to the consistency of earwax, while sebaceous glands add oily substances. Earwax also contains keratin and antimicrobial peptides, which help maintain its acidic pH and provide antimicrobial properties [2].

Earwax serves several essential functions. It forms a protective barrier that traps dust, debris, and microorganisms, thus preventing them from reaching sensitive structures in the middle and inner ear. The oily components of earwax moisturize and lubricate the ear canal, preventing dryness and itching. Its antimicrobial properties further protect against infections [4].

However, excessive buildup of earwax can lead to cerumen impaction, causing symptoms like hearing loss, tinnitus and discomfort. Treatment options include ear irrigation or manual removal by healthcare professionals [5]. Changes in the appearance of earwax can sometimes indicate underlying medical conditions affecting the ear canal [6].

Tinnitus is a condition characterized by the perception of sound in the absence of an external stimulus. It often presents as ringing, buzzing, or hissing noises that individuals hear in one or both ears. The exact mechanisms underlying tinnitus are complex and multifactorial, involving alterations in neural activity within the auditory pathways and changes in the brain’s response to sensory input [7].

Various factors contribute to the development of tinnitus, including exposure to loud noise, occluding earwax, age-related hearing loss, ear infections, and underlying health conditions such as cardiovascular disease and neurological disorders [8,9]. Psychosocial factors, including stress and anxiety, can also exacerbate tinnitus symptoms [10].

Maintaining ear health and treating associated disorders successfully need an understanding of the makeup, uses, and clinical consequences of earwax. Two tinnitus patients stated that their earwax changed after developing tinnitus; one was evaluated in the Otorhinolaryngology outpatient clinic, while the other visited the Audiovestibular Clinic at Qena University Hospitals. The query “Could cerumen characters change in patients with tinnitus?” surfaced with no answers. Therefore, the purpose of this study is to investigate cerumen alterations that could manifest in tinnitus patients.

Methods

Out of the five hundred tinnitus patients who were asked to participate in this study, only two hundred completed an informed permission form before responding to the questionnaire that the researchers had created. The Research Ethics Committee at South Valley University in Egypt gave its approval for the study’s design in

March, 2024. Artificial intelligence was used to create the questionnaire in both Arabic and English. The authors made changes that resulted in the version utilized in this investigation (Appendices I and II). The questionnaire answers were obtained and analyzed in the period from March to June 2024. SPSS version 29 was utilized for the collection and statistical analysis of the responses.

Results

Eighty-six females and 203 males participated in the study. Their age ranged from 22 to 81 years. Most of them were middle age (mean = 52.25, median = 54 and Mode = 45).

Table 1: Duration of tinnitus.

Duration of tinnitus	Frequency	Percent
Less than 1 month	12	4.2
1-3 month	10	3.5
3-6 month	17	5.9
6-12 month	38	13.1
More than 1 year	212	73.4
Total	289	100.0

Sudden onset of tinnitus was reported by 235 participants while 54 only had gradual onset. Severity of tinnitus ranged from 1 to 10 (Mean = 4.34, Median = Mode = 5).

Table 2: Cerumen changes in tinnitus patients.

Amount	Frequency	Percent
increased	58	20.1
decreased	17	5.9
no change	214	74.0
Total	289	100.0
Consistency	Frequency	Percent
Drier	41	14.2
Wetter	12	4.2
Harder	52	18.0
Softer	26	9.0
No Change	158	54.7
Total	289	100.0
Color	Frequency	Percent
Darker	38	13.1
Lighter	37	12.8
No Change	214	74.0
Total	289	100.0
Frequency	Frequency	Percent
more frequent	67	23.2
less frequent	48	16.6
no change	174	60.2
Total	289	100.0

Table 3: P values in Chi-square tests studying the effect of mode of onset, duration and severity of tinnitus on changes of cerumen (amount, consistency, color, frequency).

	Amount	Consistency	Color	Frequency
Mode of onset of Tinnitus	0.006	0.000	0.005	0.195
Duration of Tinnitus	0.000	0.000	0.000	0.000
Severity of Tinnitus	0.000	0.000	0.000	0.000

There was a negative correlation (degree -.085) with on significance (P = 0.148).

Table 4: Nominal regression analysis to predict the factors that might help us expect the severity of tinnitus.

Effect	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	7.667E2 ^a	.000	0	.
duration_of_tinnitus	9.817E2 ^b	215.010	36	.000
onset_of_tinnitus	7.851E2 ^c	18.420	9	.031
amount_earwax	7.964E2 ^c	29.789	18	.040
consistency_erwx	8.498E2 ^c	83.143	36	.000
color_earwax	7.590E2 ^c	.	18	.
frequency_earwax	7.801E2 ^c	13.396	18	.768

Discussion

The study aimed to investigate whether tinnitus is associated with changes in cerumen (earwax) characteristics among patients. A total of 289 participants were included in the analysis, revealing significant insights into the relationship between tinnitus and cerumen changes. Tinnitus patients were grouped according the duration of tinnitus (Table 1).

The amount of earwax increased in 20.1% and decreased in 5.9%. A substantial majority of patients (74.0%) reported no change in earwax amount (Table 2). This suggests that tinnitus might influence earwax production in a minority of patients.

The most significant changes were reported in earwax consistency, with notable increases in hardness (18.0%) and dryness (14.2%). Over half of the participants (54.7%) observed no changes in consistency, indicating a varied response among individuals (Table 2).

Color changes were reported by about a quarter of the participants, equally distributed between darker and lighter changes. However, the majority (74.0%) did not notice any color alteration (Table 2).

Changes in the frequency of earwax buildup were noted, with 23.2% experiencing more frequent buildup and 16.6% experiencing less frequent buildup (Table 2).

The chi-square tests evaluated the influence of tinnitus onset, duration, and severity on cerumen characteristics (Table 3). Significant results (p < 0.05) were observed for changes in earwax amount, consistency, and color concerning the mode of onset and duration of tinnitus, except for the frequency of earwax buildup, which was not significantly affected by the onset mode (p = 0.195).

Regression analysis indicated that the duration of tinnitus had a significant impact on earwax characteristics (p < 0.001 for all factors). Severity of tinnitus was also a significant predictor of earwax changes (p < 0.001 for all factors; Table 4).

These findings highlight the complexity and variability of cerumen changes among tinnitus patients. While a majority did not observe changes in cerumen characteristics, a notable proportion experienced significant alterations, particularly in earwax consistency and buildup frequency. The results suggest that tinnitus might influence earwax production and properties, potentially

through altered autonomic regulation or changes in ear canal physiology associated with tinnitus.

Understanding the relationship between tinnitus and cerumen changes is crucial for clinical management. Healthcare providers should be aware of the potential for these changes and consider them when diagnosing and treating tinnitus patients. Regular ear examinations and patient education on ear hygiene might be beneficial in managing symptoms associated with cerumen buildup.

Further research is needed to explore the underlying mechanisms of these changes and to determine whether specific subgroups of tinnitus patients are more susceptible to cerumen alterations. This study provides a foundation for future investigations and highlights the importance of comprehensive patient assessment in tinnitus management.

Conclusion

Tinnitus may lead to changes in cerumen production as well as its properties, potentially through altered autonomic regulation or changes in ear canal physiology.

Bibliography

1. Proctor B. "Anatomy and physiology of the ear canal". In *Ear Wax*. Springer, Berlin, Heidelberg (2007): 3-22.
2. Johnson C. "Physiology of the ear canal". In *Textbook of Ear, Nose and Throat Diseases*. Cambridge University Press (2002):1-10.

Appendix I

Questionnaire on Ceruminous Changes Post-Tinnitus

Introduction:

Thank you for participating in this survey. The purpose of this questionnaire is to understand the changes in earwax (cerumen) production and characteristics that may occur in individuals who experience tinnitus. Your responses will help in further understanding and managing this condition.

Instructions:

Please answer the following questions as accurately as possible. There are no right or wrong answers, and all information provided will be kept confidential.

Part 1: Demographic Data

1. Age: _____
2. Gender:
 - Male
 - Female

3. Guinan J J. "Physiology of the ear". In *Physiology of the Ear*. Springer, New York, NY (2006): 3-29.
4. Roland, P S and Marple B F. "Disorders of the external auditory canal". In *Cummings Otolaryngology: Head and Neck Surgery (4th ed.,)* (2005): 1859-1888.
5. Schwartz SR and Magit AE. "Clinical practice guideline (update): Earwax (cerumen impaction)". *Otolaryngology-Head and Neck Surgery* 156.1 (2017): S1-S29.
6. Yanagawa Y and Tsushima Y. "Aural pseudomonal infections associated with swimming pool water". *Western Journal of Emergency Medicine* 14.5 (2013): 487-488.
7. Eggermont J J and Roberts L E. "The neuroscience of tinnitus". *Trends in Neurosciences* 27.11 (2004): 676-682.
8. Baguley DM., et al. "Tinnitus". *The Lancet* 382.9904 (2013): 1600-1607.
9. Bhatt JM. "Hearing aids for tinnitus". In M. Møller (Ed.), *Textbook of Tinnitus* (2016): 499-508.
10. Langguth B., et al. "Tinnitus: Causes and clinical management". *The Lancet Neurology* 12.9 (2013): 920-930.

3. Duration of Tinnitus:

- Less than 1 month
- 1-3 months
- 3-6 months
- 6-12 months
- More than 1 year

Part 2: Tinnitus Characteristics

4. How would you describe the onset of your tinnitus?

- Sudden
- Gradual

5. How would you rate the severity of your tinnitus on a scale of 1 to 10?

- 1 (Very mild)
- 2
- 3
- 4
- 5 (Moderate)
- 6
- 7
- 8
- 9
- 10 (Very severe)

Part 3: Earwax Changes

6. Since the onset of tinnitus, have you noticed any changes in the amount of earwax produced?

- Increased
- Decreased
- No change

7. How would you describe the consistency of your earwax since experiencing tinnitus? (Check all that apply)

- Drier
- Wetter
- Harder
- Softer
- No change

8. Have you experienced any changes in the color of your earwax since the onset of tinnitus?

- Darker
- Lighter
- No change

9. Have you noticed any changes in the frequency of earwax buildup since the onset of tinnitus?

- More frequent
- Less frequent
- No change

Thank you for your kind participation.

Appendix II

نذالاً نينطب ةباصإلا دعب نذالاً عمش يف تاريختلا لوح نايبتسا

ةمدقم:

صاخشألل شدحت دق يتلا (خالصلال) نذالاً عمش صئاصخو جاتنإ يف تاريختلا مهف وه نايبتسال اذه نم فدلما . نايبتسال اذه يف مكنتكراشم اركش اهتدادو لصفأ لكشب ةلجال هذه مهف يف مكنتاباج اندعاس تس . نذالاً نينطب نم نوناعي نيدلا

تاملعتلا:

ةمدقملا تامول عملا عيمج ةيرس يل ع ظافحلما مئيسو ، ةئطاخ وأ ةححص تاباج دجوت ال . نالكمل ا ردق ةقوبب ةيلاتلا ةلئسال يل ع ةباجال ا يجرى

ةيفارغوم يدلا تامول عملا : لوالأ عزجال

ةنس _____ : رملال 1-

سنجال 2-

ركذ [] -

يشنأ [] -

نذالاً نينطب ةباصإلا دم 3-

رهش نم لقلأ [] -

رهشأ 1-3 [] -

رهشأ 3-6 [] -

رهش 6-12 [] -

ةنس نم رثكأ [] -

نذالاً نينطب صئاصخ : بيناتلا عزجال

ةكيدل نذالاً نينطب ةيادب فصت فيك 4-

ةيئاجف [] -

ةيجيردت [] -

10؟ يل 1 نم سايقم يل ع كيدل نذالاً نينطب ةدش ميقت فيك 5-

(اُج فيفخ) 1 [] -

2 [] -

3 [] -

4 [] -

(طسوتم) 5 [] -

6 [] -

7 [] -

8 [] -

9 [] -

(اُج ديدش) 10 [] -

نذالاً عمش تاريخت : ثلاتلا عزجال

6-؟ نذالاً عمش ةيمك يف تاريخت يأ تظحال له ، نذالاً نينطب ةيادب ذم

ةدايز [] -

ناصقن [] -

ريغت ال [] -

7- (قبطن ي ام لك رتخا) ؟ نذالاً نينطب ةباصإلا ذم نذالاً عمش ماوق فصت فيك

افتافج رثكأ [] -

تبطر رثكأ [] -

- [] قبالص رثكأ
- [] قوموعن رثكأ
- [] ريغت ال

8-؟نذال انينطةيادب ذنم نذال اعمش نول يف تاريخت يأ تظحال له

- [] قمغأ
- [] حتفأ
- [] ريغت ال

9-؟نذال انينطةيادب ذنم نذال اعمش مكارت قريتو يف تاريخت يأ تظحال له

- [] ازاركت رثكأ
 - [] ازاركت لقا
 - [] ريغت ال
- !مكتكراشم اركش