

# Acute Stress Induces Cerumen Secretion: Case series of Four Medical Students during Exams

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## Research Article

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# Abstract

**Background and Objectives:** Cerumen is a common physiological condition; it only becomes a problem if it causes a hearing impairment or other ear-related symptoms. There is increasing evidence for a relationship between stress and hearing problems. The study aims to understand the association between acute stress and increasing cerumen secretion among medical students during exams.

**Materials and Methods:** The study is a retrospective, single-center, and consecutive case series conducted in Benha University Hospitals in Egypt. We defined four cases of medical students who complained of earwax accumulation during their final exams from the 15th to the 13th of July 2021.

**Results:** Four medical students participated in the study. Younger Females and males' percentages were equal, and the mean age was 19.625 years old. Headache, ear discomfort, and ear pruritus are most common, followed by tinnitus, ear debris, and otitis media with effusion, while hearing loss, fever, and ear pain are slightly rare. The bilateral accumulation of earwax is typical than unilateral accumulation. Remowax was used in almost of cases and then ear wash. Males had high perceived stress, while females had moderate stress.

**Conclusions:** This retrospective case series showed an association between acute stress and excessive cerumen secretion among small medical students during their final exams.

## 1. Introduction

Cerumen or earwax is the common condition which every otolaryngologist sees in their clinical practice [1]. Wax production is a normal physiology process to protect the ear, but certain factors affect this process as age, external auditory canal diameter, and condition of the tympanic membrane [1]. Earwax only becomes a problem if it causes a hearing impairment or other ear-related symptoms [2]. The accumulation of wax occurs for many reasons, including the over-or under-production of its constituent components, a failure to self-clear because of slow skin migration, or mechanical issues such as using cotton buds or hearing aids [2]. There is increasing evidence for a relationship between stress and hearing problems; its causality is not well-established [3]. An experimental animal study showed a good role of acute stress in protecting the auditory system from a subsequent noise trauma [4]; however, this direct evidence for the effects of stress, whether acute or chronic, has not yet been directly tested on human hearing. The critical role is still unknown whether stress induces hearing problems or consequences [3]. It is plausible that the association is bidirectional, i.e., hearing problems are stressful, and that stress causes increased vulnerability to hearing problems [3]. The association between ear wax and stress be presented as the earwax sample's role in giving accurate cortisol levels measures [5], and cortisol is one of the stress hormones [6]. So, ear wax is a new, cheap, and accurate way to evaluate stress levels [5]. Stress, anxiety, and behavioral changes are spread between students around the world [7], [8] and with increasing rate during coronavirus disease 2019 (COVID-19) pandemic [9], [10]. This case series aims to

understand the correlation between acute stress and increasing cerumen secretion among medical students during exams.

## **2. Material And Methods**

The study is following the PROCESS 2020 Guideline: Updating Consensus Preferred Reporting Of Case Series in Surgery (PROCESS) Guidelines [11], and The CARE Guidelines: Consensus-based Clinical Case Reporting Guideline Development [12].

### **2.1. Study Design and Setting**

The study is a retrospective, single-center, and consecutive case series conducted in Benha University Hospitals in Egypt.

### **2.2. Data Collection**

We defined four medical students who complained of earwax accumulation during their final exams from the 15th to the 13th of July 2021. The cases were identified based on a prior examination by an otolaryngologist that examined their ear condition by hand-held otoscope. All enrolled patients' data were collected by demographic characteristics, ear history as symptoms and signs, and stress condition of all enrolled patients. According to the degree of occlusion scale [13], the patients were classified into no occlusion, mild, moderate, and complete occlusion of the ear. At the same time, the patients were classified by perceived stress scale into low, moderate, and high perceived stress [14].

### **2.3. Ethical Consideration**

#### **Informed consent**

was obtained in written form from the four cases. Ethical approval was obtained from the Research Ethical Committee (REC) in the Faculty of Medicine – Benha University (Ethical Approval Number: RC 4-7-2021).

### **2.4. Data Analysis**

All cases data were presented in an excel sheet for management and analysis. Continuous variables were expressed using mean and standard deviation for normally distributed data and the median and interquartile for skewed data.

## **3. Results**

### **3.1. Baseline Demographic and Clinical Characteristics**

A total of four medical students participated in the study during their final exams. Females and males' percentages were equal. All participants were younger, and the mean age was 19.625 years old. The

blood pressure was slightly normal, and the mean of the systolic blood pressure was 120 mm/Hg, while the mean of the diastolic blood pressure was 75 mm/Hg (**Table 1**).

### **3.2. Ear Condition**

Headache, anxiety, ear discomfort, and ear pruritus are most common, all participants complain. Tinnitus, malaise, anorexia, ear debris, and otitis media with effusion are very common; 75% of participants complain about them. Ear congestion was presented equally in 50% only of participants. Hearing loss, fever, ear pain, irritability, erythema, impact ear wax, and chronic suppurative otitis media are slightly rare, only appeared in 25% of participants (**Table 1**).

### **3.3. Wax Amount**

Case 1 and 3 had a moderate amount of wax bilaterally, causing moderate bilateral occlusion (score = 2), While Case 2 had mild wax bilaterally causing mild bilateral occlusion (score = 1). In contrast, case 4 had severe wax unilaterally that caused severe unilateral occlusion of the left ear (score = 3) (**Table 2**).

### **3.4. Treatment of Choice**

Case 1 and 3 had the same course of treatment. Firstly, Remowax (carbamide peroxide in glycerol 5%) five times for two days and then ear wash, While Case 2 takes only Remowax (carbamide peroxide in glycerol 5%) times for two days. In contrast, case 4 had immediate ear wash (**Table 2**).

### **3.5. Perceived Stress Scale**

Case 1 and 4 are females, and they had moderate stress with scores 25 and 26, respectively.

In contrast, cases 2 and 3 are males and had high perceived stress with scores 28 and 27, respectively (**Table 3**).

## **4. Discussion**

The previous literature has many studies that discuss the relation between stress and emotional exhaustion and hearing problems as hearing loss and tinnitus. Hasson et al. [15] found a robust linear relationship between a higher prevalence of hearing problems (tinnitus or hearing loss or both) and stress factors. Hébert et al. [16] found that emotional exhaustion in both sexes and coping in males only strongly increased the odds of tinnitus prevalence and severity. Also, Hébert et al. [17] in another study showed that tinnitus participants displayed a blunted cortisol response to psychosocial stress, in comparison with healthy controls who had a typical cortisol release about 30 minutes after the beginning of the experiment and their cortisol response is similar to that found in other bodily stress-related diseases and thus suggests that tinnitus is related to stress. Our study focuses on the medical students who complained about excessive earwax secretion. We hypothesize an association between acute stress and excessive cerumen secretion among medical students during their exams.

In our study, females' and males' percentages were equal, while in Hasson et al. [15] and A. Hearne-Vives et al. [5] studies, females were more than males. In contrast, males were more than females in Manchaiah V et al. study [18]. The mean age was 19.625 years old, while the mean age was 48.6 in Hasson et al. [15] study, 82.72 years in Manchaiah V, et al. study [18], and 29.9 years A. Here-Vives et al. [5] study. Ear discomfort was the comment symptom in our study and also the previous literature [5], [18], [19]. Among the three cases having tinnitus, there were two males and one female, and these results agree with the evidence that tinnitus is more affected than females [20], [21]. In contrast, with the evidence that hearing loss is more affected by males than females (20,21), the alone case had a female hearing loss. Manchaiah V et al. study [18] showed that bilateral accumulation of earwax is typical than unilateral as in our study. The mean of the perceived stress scale in our study was 26.5 (moderate stress), in agreement with Herane-Vives et al. [5] study that the perceived stress scale mean was 22.6 (moderate stress). Xu, Xiao et al. [22] showed that women have more significant psychological stress than men, while our study showed that males had high perceived stress and females had moderate stress.

## 5. Conclusions

In conclusion, our retrospective case series showed an association between acute stress and excessive secretion among small medical students during their final exams. Ear discomfort and tinnitus were the comment symptoms in our study and the previous literature, and the bilateral accumulation of earwax is typical than unilateral accumulation. This study showed that males had high perceived stress and females had moderate stress. We recommend more studies with large samples to approve the association or establish a causative hypothesis for future research. The learned Lesson students should decrease their stress during exams.

## Declarations

Competing interests: The authors declare no competing interests.

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## Tables

**Table 1: Baseline and Ear Condition of Four Cases**

<b>Data Variables</b>	<b>Number (%)</b>
<b>Baseline demographic and clinical characteristics</b>	
Number of Cases	4 (100%)
Age Mean (SD) [year]	19.625 (0.414)
Gender	
1. Females	2 (50%)
2. Males	2 (50%)
Blood Pressure Mean (SD) [mm/Hg]	
1. Systolic	120 (7.071)
2. Diastolic	75 (11.180)
<b>Ear Condition</b>	
Tinnitus	
1. Yes	3 (75%)
2. No	1 (25%)
Headache	
1. Yes	4 (100%)
2. No	0 (0%)
Hearing loss	
1. Yes	1 (25%)
2. No	3 (75%)
Malaise	
1. Yes	3 (75%)
2. No	1 (25%)
Fever	
1. Yes	1 (25%)
2. No	3 (75%)
Anorexia	
1. Yes	3 (75%)
2. No	1 (25%)
Anxiety	

1. Yes	4 (100%)
2. No	0 (0%)
Ear discomfort	
1. Yes	4 (100%)
2. No	0 (0%)
Ear Pain	
1. Yes	1 (25%)
2. No	3 (75%)
Irritability	
1. Yes	1 (25%)
2. No	3 (75%)
Ear Pruritus	
1. Yes	4 (100%)
2. No	0 (0%)
Ear Debris	
1. Yes	3 (75%)
2. No	1 (25%)
Ear Congestion	
1. Yes	2 (50%)
2. No	2 (50%)
Erythema	
1. Yes	1 (25%)
2. No	3 (75%)
Impact Earwax	
1. Yes	1 (25%)
2. No	3 (75%)
Otitis Media with Effusion	
1. Yes	3 (75%)
2. No	1 (25%)
Chronic Suppurative Otitis Media	

1. Yes	1 (25%)
2. No	3 (75%)

**Table 2: Wax Amount and Treatment of Choice**

Case Number	Wax Amount	Degree of Occlusion	Degree of Occlusion Score	Treatment of Choice
Case 1	Bilateral Moderate Amount	Bilateral Moderate Occlusion	2	1. Remowax (Carbamide peroxide in glycerol 5%) five times for two days  2. Ear wash
Case 2	Bilateral Mild Amount	Bilateral Mild Occlusion	1	1. Remowax (Carbamide peroxide in glycerol 5%) five times for two days
Case 3	Bilateral Moderate Amount	Bilateral Moderate Occlusion	2	1. Remowax (Carbamide peroxide in glycerol 5%) five times for two days  2. Ear wash
Case 4	Unilateral Severe Amount (Left Ear)	Unilateral Severe Occlusion (Left Ear)	3	1. Immediate ear wash

**Table 3: Perceived Stress Scale of Four Cases**

Case Number	Gender	Perceived Stress Scale	Result Scores
Case 1	Female	Moderate Stress	25
Case 2	Male	High Perceived Stress	28
Case 3	Male	High Perceived Stress	27
Case 4	Female	Moderate Stress	26