Original Article

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Effect of cerumen removal among institutionalized elderly individuals: hearing and the relationship between earwax type and accumulation

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Abstract

Objective: To investigate the effects of cerumen removal among institutionalized elderly individuals, we evaluated changes in hearing with cerumen removal by nursing staff and the relationship between earwax type and accumulation.

Methods: This study included 10 subjects (19 ears) without abnormalities of the external auditory meatus (EAM), with a mini-mental state examination score ≥21, and in whom audiometry could be performed (One ear was excluded from the study because hearing test could not be performed). Over a 12-week period, the EAM was examined every 2 weeks. If the EAM was at least half occluded by cerumen, cerumen removal from the cartilaginous EAM was performed using a cotton swab. In terms of hearing, the air-bone gap was calculated from air conduction and bone conduction hearing levels. Criteria for cerumen accumulation, based on the degree of EAM occlusion by cerumen, were divided into 4 grades: completely occluded; half occluded; one-third occluded; and unoccluded. Earwax type was classified as wet-type earwax or dry-type earwax.

Results: At baseline, before cerumen removal, the EAM was at least half occluded by cerumen in 7 ears (36.8%). After 12 weeks, of these 7 ears, 1 remained half occluded, 1 remained a third occluded and 5 were unoccluded. Hearing before and after cerumen removal was evaluated by audiometry in 10 ears. In 9 ears, excluding the 1 ear that remained completely occluded, the threshold after removal decreased significantly compared to before removal, with improved hearing (air conduction hearing, 35.4 dB before vs. 32.8 dB after, P=0.043; air-bone gap: 5.8 dB before vs. 2.8 dB after, P=0.002, paired *t*-test). The rate of severe earwax accumulation (at least half occluded) was significantly higher with wet-type earwax (8 ears) than with dry-type earwax (11 ears) (P=0.001, Cramer's *V* test). Earwax accumulation time (from unoccluded to one-third or to-half occluded) was about 8 weeks. No difference between earwax types was identified.

Discussion: Cerumen removal improved hearing. Wet-type earwax accumulated more easily than dry-type earwax. Cerumen removal by nursing staff requires examination of the EAM and thus provides preventive earwax accumulation.

Key words

cerumen removal, institutionalized elderly individuals, intervention, earwax accumulation, earwax type

Introduction

Decreased auditory function in the elderly is mainly due to sensorineural hearing loss, but conductive hearing loss due to cerumen impaction can also occur when earwax fills or occludes the external auditory meatus (EAM)[1]. Cerumen impaction reportedly affects 35% of elderly hospital patients[2] and 40-57% of nursing home

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residents[3] due to decreased self-care.

With regard to cerumen removal and hearing, the EAM is reportedly at least half occluded by earwax in 65% of elderly patients in skilled nursing facilities (SNF), with hearing and cognitive function improving after cerumen removal.[4] Cerumen impaction is also seen in 35% of elderly hospital patients, and improved hearing has been reported in 75% of ears that required irrigation of the ear canal[2]. Cerumen removal can be performed by an otolaryngologist using ceruminolytic agents or irrigation of the EAM, and hearing is measured by simple methods. On audiometry, after removal of impacted cerumen, improvement of 5–40 dB in air conduction hearing[3] and about 20 dB in the air-bone gap[5] has been observed. These results are not limited to elderly persons. In addition, earwax can be classified as wet-type or dry-type, with proportions of these types varying among ethnic groups[6]. Wet-type earwax is predominant in Westerners[7], whereas only 17% of Japanese show wet-type earwax[1]. However, little research has examined cerumen removal and earwax type.

Regarding needs and care methods for cerumen removal by nursing staff, researchers[8] have found that in institutionalized elderly individuals, about 20% show occlusion of at least half of the EAM due to cerumen. Factors associated with accumulation include "older age" and "wet-type earwax". Moreover, EAM examination and cerumen removal every 4 weeks can prevent cerumen accumulation[9], and safety standards have been established for cleaning the cartilaginous EAM[10]. However, in terms of the effects of cerumen removal performed by nursing staff, changes in hearing with cerumen removal and the relationship between earwax type and accumulation have not been investigated. In addition, we have not seen any longitudinal studies on cerumen removal and the time course of cerumen accumulation.

This study aimed to investigate the effects of cerumen removal in elderly individuals requiring care. Longitudinal intervention with cerumen removal over a 12-week period was performed by nursing staff for institutionalized elderly individuals. We evaluated changes in hearing with cerumen removal, and also examined the relationship between earwax type and accumulation.

Definition of terminology

In this study, cerumen removal was defined as the removal of cerumen from the cartilaginous EAM, approximately 1 cm from the opening of the EAM, performed by a nurse. Therefore, even after removal of cerumen by the nurse, occluded cerumen may remain in the osseus EAM.

Methods

1. Study design

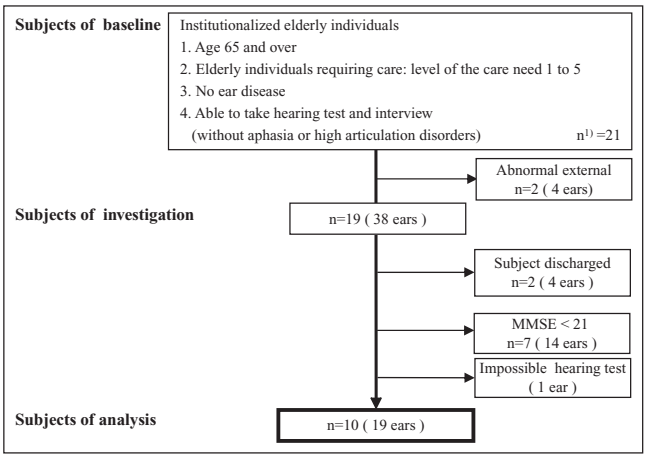
This research employed a semi-experimental design, with cerumen removal in institutionalized elderly individuals, and evaluation of changes in hearing before and after intervention.

2. Study population (Fig. 1)

Subjects were residents in a senior care facility. Selection criteria for subjects are shown in Figure 1. Exclusion criteria were: any abnormality of the EAM; mini-mental state examination (MMSE) score <21; deviation from normal in terms of cognitive function; or an ear in which audiometry could not be performed. Subjects comprised 10 subjects (19 ears).

3. Method of cerumen removal

Standards for cerumen removal (Table 1) have been established for EAM examination, cerumen removal, and the evaluation process[1),9-10)]. Using the standards allows for the safe removal of cerumen by the nurse. Examination and cerumen

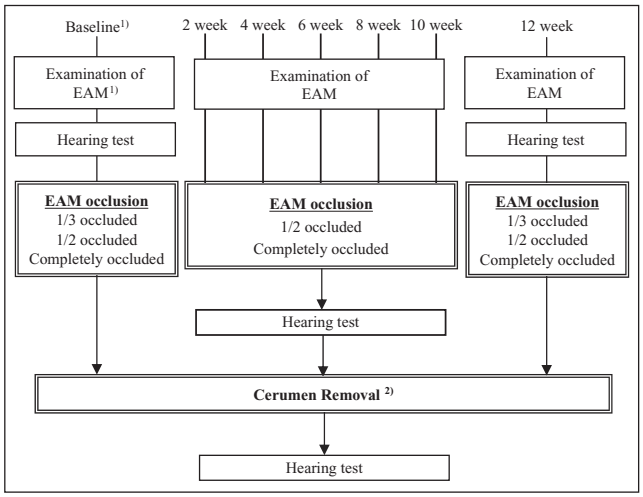


1) Number of subjects

Figure 1. Selection criteria for subjects

Table 1. Cerumen removal standards

Item	Method
1. Examination of external auditory meatus (EAM)	[Time] Every 2 weeks [Exam] EAM, tympanic membrane, degree of cerumen accumulation [Methods] <1> Subject should be seated in a wheelchair or chair with a backrest. <2> Gently pull the pinna upward and examine the EAM and tympanic membrane with an otoscope. <3> If needed, a caregiver (nurse) should support the subject's head.
2. Cerumen removal	[Subject] Ears with cerumen in the cartilaginous EAM [Instruments] Headlight, children's cotton swab, baby oil, and, if needed, cerumen forceps [Methods] <1> Subject should be seated in a wheelchair or chair with a backrest. <2> Gently pull the pinna upward to visualize the EAM. <3> Limit cerumen removal to the cartilaginous EAM. <4> If needed, the caregiver (nurse) should support the subject's head.
3. Evaluation	[Time] When examining the EAM and after cerumen removal [Evaluation] Assessment of cerumen removal [Points to remember] ● If cerumen remains in the osseous EAM, apply baby oil to the cerumen and EAM. ● For cerumen removal, postpone until cerumen has moved into the cartilaginous EAM.



1) External auditory meatus
2) Can't remove cerumen; 1. Cerumen in the osseous EAM, 2. Poor conditions

Figure 2. The course of cerumen removal intervention over the 12 weeks

removal were performed by a nurse researcher. Cerumen was removed from the inside of the cartilaginous EAM. Even after removal of cerumen, the osseous EAM may remain occluded with cerumen. The cerumen was removed by a nurse using a children's cotton swab (about 3 mm across) and baby oil, which softens and loosens the cerumen[11]. Use of ceruminolytic ear drops or irrigation of the ear canal under the direction of a physician was not performed.

The cerumen removal intervention (Fig. 2) was performed according to the standards. The intervention period was 12 weeks, with examinations performed every 2 weeks[9]. Cerumen was removed from all ears in which any earwax was observed in the EAM at baseline and 12 weeks. From 2 weeks and 10 weeks, cerumen was removed from ears in which the EAM was at least half occluded by cerumen[4]. If cerumen was identified in the osseous EAM, or the subject was in poor health, cerumen removal was postponed. These cerumen removal standards were decided in consultation with a specialist in otolaryngology.

4. Evaluation methods

1) Evaluation period

Evaluation period was from November 4, 2009 to March 4, 2010.

2) Data collection method

(1) Examination of external auditory meatus

The EAM was examined by a nurse with an otoscope, with imaging using Digital Macro View™ otoscope software (Welch Allyn, U.S.A). Criteria for cerumen accumulation[8・9], based on the degree of EAM occlusion by cerumen, were divided into 4 grades: completely occluded; half occluded; one-third occluded; and unoccluded (Fig. 3). Earwax type at the time of examination for cerumen accumulation was classified by the nurse as dry-type earwax (dried earwax) or wet-type earwax (soft, yellowish-brown earwax). If classification was difficult, the nurse consulted

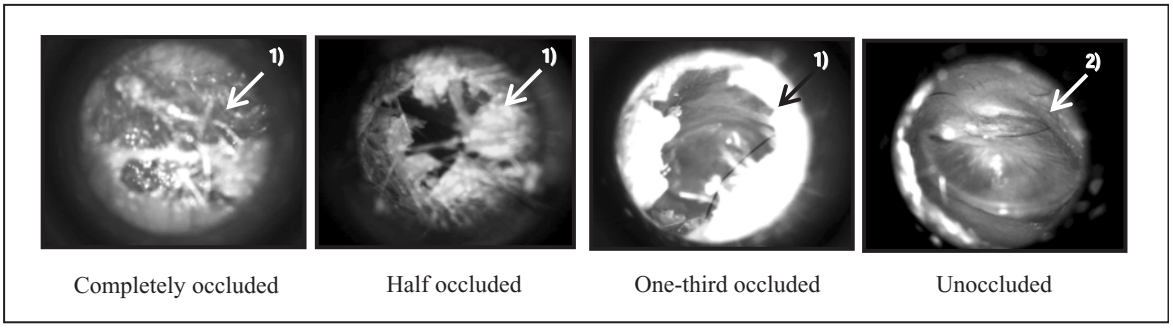


Figure 3. Criteria for cerumen accumulation

with a specialist in otolaryngology to make a decision based on EAM imaging and examination findings.

(2) Audiometry and subjective hearing

Audiometry was performed using an audiometer (AA-77; RION, Japan). All testing was performed in a single room of the facility with an ambient noise level ≤40 dB as measured using a sound level meter (SL-1370; Custom, Japan).

Measured frequencies of air conduction and bone conduction hearing were in the speech band used in daily activities, with screening for hearing loss at 3 frequencies: 0.5 kHz; 1 kHz; and 2 kHz. Air conduction and bone conduction hearing are expressed as mean hearing levels (quartering). Defining the 0.5-kHz hearing level as A dB, 1-kHz is B dB and 2-kHz is C dB, and mean hearing is calculated as [(A+2B+C)×1/4] (quartering). As a parameter of hearing improvement with cerumen removal, the air-bone gap was used to indicate the degree of conductive hearing loss. The air-bone gap is the difference between air conduction and bone conduction hearing. With cerumen occlusion of the EAM, cerumen obstructing the EAM limits air conduction and thus causes conductive hearing loss. As bone conduction remains unaffected, the air-bone gap increases. With hearing improvement following cerumen removal, the air-bone gap decreases.

In subjects unable to push a button, for example, due to paralysis or sensory disturbance, responses were confirmed by raising the hand or uttering "yes". If a maximum sound pressure level could not be measured, data were excluded from analysis. Speech audiometry was selected to assess the effect that cerumen accumulation has on reduced speech discrimination due to aging. Bone conduction hearing was evaluated with uniform 40-dB masking.

Speech discrimination testing[12] was performed to evaluate the ability to recognize words at a threshold for most audible sound (maximum acuity). For testing, maximum acuity was set 40 dB above the threshold for air conduction hearing at 1 kHz in each ear[13]. Using a 67-S word list CD by the Japan Audiological Society, monosyllabic words (20 syllables) were listened to, and the subject was asked the sound of each syllable. The examiner judged the results and calculated the correct response rate.

To evaluate subjective hearing, a board displaying "can you hear (my voice)" and a 5-step scale[2] were displayed. A reply was requested by pointing, then the selection made in response was observed. Audiometry and subjective hearing were evaluated at the start of cerumen removal, after EAM examination at 12 weeks, and before and after cerumen removal.

To evaluate daily activity status, institutional care staff were asked whether "responses when speaking to the subject" during daily contact with each subject were the "same" or "different", and the results were recorded. For 1 week after cerumen removal, any bleeding or pain of the EAM was also documented.

(3) Baseline attributes

Sex, age, level of required care, and food intake, including swallowing function, were reviewed

Table 2. Earwax impaction and hearing at baseline

Mean (SD)

Earwax impaction		Air-bone gap[1] dB	Air conduction hearing dB	Bone conduction hearing dB	Speech discrimination %
Completely[2]	n=5	5.5 (5.1)	35.8 (15.8)	30.3 (11.9)	56.0 (42.0)
1/2 occluded	n=2	10.7 (11.5)	26.9 (6.2)	16.3 (5.3)	95.0 (0.0)
1/3 occluded	n=7	3.4 (3.2)	34.5 (11.0)	31.3 (12.0)	79.3 (22.6)
Unoccluded	n=5	5.2 (3.8)	28.0 (11.4)	22.8 (8.9)	89.0 (8.2)
Total	n=19	5.2 (4.9)	32.3 (11.9)	27.2 (14.6)	77.4 (27.9)

1) The air-bone gap is the difference between air conduction and bone conduction hearing.
2) Comletely occluded

from the medical records. Cognitive function was evaluated using the MMSE[14]. Activities of daily living were assessed using the Barthel index (BI)[15]. A request was made for evaluation by a physical therapist at the facility.

5. Method of analysis

Each factor variable was analyzed using descriptive statistics and estimation statistics. Hearing before and after cerumen removal, at baseline and 12 weeks were compared using paired *t*-tests. In the analysis of earwax type, dry-type earwax (dry-type group) and wet-type earwax (wet-type group) were compared in terms of earwax accumulation and hearing, with testing for independence using the paired *t*-test, χ^2 test, or Cramer's coefficient of contingency. Statistical analysis was performed using SPSS for Windows® version 15.0 J software (Chicago, USA).

6. Ethical considerations

The nature of the study, protection of anonymity, protection of rights, voluntary participation, the right to refuse, assurance of safety, and regards for facility services were explained, verbally and in writing, to each subject in the presence of the facility director, and written informed consent was obtained. This study was approved by the Ethics Committee at Oita University Faculty of Medicine (Approval No. 282).

Results

1. Baseline attributes and earwax type

Subjects comprised 7 women (70.0%) and 3 men (30.0%), with a mean (±standard deviation) age of 81.2±10.8 years. Care level was level 2 in 8 subjects (80.0%), level 3 in 1 subject and level 1 in 1 subject (10% each). MMSE score was 25.9±2.4, and BI was 73.5±16.7. All subjects were able to take food orally. Earwax type was wet-type in 4 subjects (40.0%) and dry-type in 6 subjects (60.0%).

2. Cerumen accumulation and hearing

At baseline, before cerumen removal, the EAM was completely occluded in 5 ears (26.3%) and half occluded in 2 ears (10.5%). Severe cerumen accumulation was thus seen in about 40% of subjects. Cerumen was not seen in 5 ears (26.3%), defined as unoccluded.

For mean hearing before the start of cerumen removal, the air-bone gap was 5.2±4.9 dB, the air conduction hearing level was 32.3±11.9 dB, the bone conduction hearing level was 27.2±14.6 dB, and speech sound hearing was 77.4±27.9% (Table 2). For the 4 grades of cerumen occlusion, mean hearing, in terms of air-bone gap, was as follows: completely occluded, 5.5 dB; half occluded, 10.7 dB; one-third occluded, 3.4 dB; and unoccluded, 5.2 dB. No correlation was observed between the grade of cerumen occlusion in the EAM and air-bone gap, air conduction hearing, or bone conduction hearing.

3. From intervention of cerumen removal to 12 weeks, the course of cerumen accumulation and changes in hearing (Table 3)

Table 3 shows the 12-week from the start of cerumen removal in 19 ears. At baseline, before cerumen removal, 5 ears were completely occluded. After cerumen removal, 2 ears remained completely occluded, 2 ears were half occluded and 1 ear was unoccluded. Before cerumen removal 2 ears were half occluded; after cerumen removal both were unoccluded. Over the 12 weeks, these 7 ears of completely occluded and half occluded at baseline,

Table 3. Cerumen removal and accumulation over the 12 weeks

Earwax type	Baseline[1] Before[2]	After[3]	2 week Before	After	4 week Before	After	6 week Before	After	8 week Before	After	10 week Before	After	12 week Before	After
Wet	com.[4][5]	com.	com.	[9]	com.		com.		com.		com.	—	—	
	com.	com.	com.		com.		com.	—	—		1/3		—	
	com.	1/2[6]	1/2		1/2		1/2		com.	1/2	1/2		1/2	1/2
	com.	1/2	1/2		1/2		1/2	—	—		—		—	
	com.	—[7]	—		1/3		—		1/2		1/3		1/3	—
	1/2	—	—		—		—		—		—		1/3	—
	1/2	—	—		—		1/3		1/3		—		1/3	1/3
	1/3[8]	—	—		—		—		—		1/3		1/2	—
Dry	1/3	—	—		—		1/2		1/2		1/2		1/2	—
	1/3	—	—		—		1/3		—		—		—	
	1/3	—	—		—		—		—		—		1/3	—
	1/3	—	—		—		—		—		—		1/3	
	1/3	—	—		—		—		—		—		—	
	1/3	—	—		—		—		—		—		—	
	—		1/3		1/3		1/2	—	—		—		—	
	—		—		1/3		1/3		1/3		1/2		1/2	—
	—		—		—		—		—		—		1/3	—
	—		—		—		—		—		—		—	
	—		—		—		—		—		—		—	

1) The start of cerumen removal intervention
2) Before cerumen removal
3) After cerumen removal
4) ▒ : hearing before and after cerumen removal
5) Completely occluded
6) 1/2 occluded
7) Unoccluded
8) 1/3 occluded
9) No removal

1 remained half occluded, 1 remained a third occluded and 5 were unoccluded.

At baseline, 5 ears were unoccluded. Over the 12 weeks, 2 of these ears became half occluded, 1 became a third occluded and 2 remained unoccluded. During the 12 weeks study period, cerumen was removed from 16 ears.

Of the 16 ears with cerumen removal, audiometry could be performed before and after cerumen removal in 10 ears (7 subjects, including both ears in 3 subjects), and changes in hearing were analyzed (Table 4). In subjects going from completely occluded to unoccluded, from completely occluded to half occluded, or from half occluded to unoccluded, respective air-bone gaps tended to decrease after removal compared to before cerumen removal, but no significant differences were observed. Regarding the air-bone gap and air conduction hearing in these 9 ears, gap and threshold after cerumen removal were significantly decreased compared to before cerumen removal, with improvements in hearing (air-bone gap: 5.8

Table 4. Earwax impaction and hearing before and after ceruen removal

	Earwax impaction			Air-bone gap dB		Air conduction hearing dB		Bone conduction hearing dB		Speech discrimination %	
				Mean (SD)		Mean (SD)		Mean (SD)		Mean (SD)	
①	Before	Completely[1]	n=3	5.4 (6.4)		36.7 (18.2)		31.3 (11.9)		63.3 (55.0)	
	After	Unoccluded		2.9 (5.0)		35.0 (19.6)		32.1 (14.6)		65.0 (52.2)	
②	Before	Completely	n=2	4.4 (2.6)		35.0 (12.5)		30.7 (15.1)		60.0 (49.5)	
	After	1/2 occluded		0.0 (0.0)		30.7 (16.8)		30.7 (16.8)		60.0 (42.4)	
③	Before	1/2 occluded	n=4	6.9 (8.3)	+	34.7 (11.0)		28.2 (15.0)		86.3 (14.4)	
	After	Unoccluded		4.1 (7.3)		32.2 (13.8)		28.2 (15.4)		91.3 (8.5)	
④	Before	Completely	n=1	0.0	–	21.3	–	21.3	–	70.0	–
	After	Completely		5.0		21.3		16.3		70.0	
	Before	①②③	n=9	5.8 (6.2)	*	35.4 (13.0)	*	29.7 (12.3)		72.8 (36.2)	
	After	(except ④)		2.8 (5.4)		32.8 (14.3)		30.0 (13.4)		75.6 (34.0)	

1) Comletely occluded

Paired *t*-test * : P<0.05 + : <0.5

Table 5. Relationship of earwax type to cerumen accumulation

ears (%)

Earwax impaction		Wet type n=8	Dry type n=11	P value
Completely [1]	n=5	5 (100)	0 (0.0)	0.001*
1/2 occluded	n=2	2 (100)	0 (0.0)	
1/3 occluded	n=7	1 (14.3)	6 (85.7)	
Unoccluded	n=5	0 (0.0)	5 (100)	

1) Completely occluded Cramer' *V* test *<.05

dB before vs. 2.8 dB after, P=0.002; air conduction hearing: 35.4 dB before vs. 32.8 dB after, P=0.043).

For subjective hearing, responses before starting were "I can hear well" by 6 subjects and "I can hear" by 1 subject. These were the same before and after cerumen removal. Responses by staff when speaking to subjects during daily activities were "same" in 6 subjects and "different" in 1 subject. In the free descriptions, one comment stated that "the subject became easier to understand". After cerumen removal, no subjects displayed bleeding or pain in the EAM.

4. Relationships of earwax type to cerumen accumulation, hearing, and cerumen removal (Table 3, Table 5)

We compared the wet-type group (4 subjects, 8 ears) and dry-type group (6 subjects, 11 ears). In terms of earwax type and accumulation, at the start of cerumen removal in the wet-type group, 5 ears (representing 100% of the completely occluded ears) were completely occluded and 2 ears (representing 100% of the half occluded ears) were half occluded. Compared to the dry-type group, the wet-type group showed a significantly higher rate of severe cerumen accumulation (P=0.001) (Table 5). With respect to earwax type and hearing levels, the air-bone gap at baseline was 7.3 dB in the wet-type group and 3.7 dB in the dry-type group. The air-bone gap tended to be lower in the dry-type group than in the wet-type group, but no significant difference was evident (P=0.108).

The 5 ears defined as completely occluded before the start of cerumen removal were all in the wet-type group. Of these, cerumen in 4 ears was completely removed at 12 weeks (Table 3). The removal period was at the start in 1 ear, 6 weeks in 2 ears, and 10 weeks in 1 ear. On the other hand, during the 12 weeks, the 4 ears identified as unoccluded were all in the dry-type group.

Next, we analyzed the 15 ears that were unoccluded at the start of cerumen removal or after cerumen removal at baseline. During the 12 weeks, 10 ears (66.6%) progressed from unoccluded to one-third occluded, with a mean accumulation time of 8.0±4.0 weeks (range, 2-12 weeks). For these ears progressing from unoccluded to one-third occluded, no difference was apparent between the wet-type and dry-type groups (4 ears of wet-type 8.0±4.0 weeks vs. 6 ears of dry-type 8.0±4.6 weeks, P=0.5). Five ears (33.3%) progressed from unoccluded to half occluded, with a mean accumulation time of 8.4±2.6 weeks (range, 6-12 weeks). For these ears progressing from unoccluded to half occluded, no difference was apparent between the wet- and dry-type groups (2 ears of wet-type 10.0±2.8 weeks vs. 3 ears of dry-type 7.3±2.3 weeks, P=0.163).

Discussion

1. Effects of cerumen removal on hearing

Cerumen was removed from the EAM of ears with severe cerumen accumulation, namely, half occlusion or complete occlusion. As a result, air conduction hearing threshold and air-bone gap decreased significantly. The difference in air-bone gap between before and after cerumen removal was 3.0 dB (before, 5.8 dB; after, 2.8 dB), and the difference in air conduction hearing was 2.6 dB (before, 35.4 dB; after, 32.8 dB) showing hearing improvement. Compared with previously reported improvements in the air-bone gap of about 21 dB[5] and in air conduction hearing from 5 to 40 dB[3], our values were lower. However, subjects in our study who underwent cerumen removal showed EAMs that were half occluded or completely occluded at a stage prior to cerumen impaction. Cerumen impaction is a condition in which the EAM becomes tightly packed by cerumen. Subjects in this study who underwent cerumen removal had not reached a stage of cerumen impaction. Therefore air conduction was not blocked, and no

marked decreases in air conduction hearing were thus encountered, as reflected in air-bone gap values. Conversely, the cause of decreased auditory function due to aging is mainly impairment of inner ear hearing levels due to a loss of auditory hair cells or decreased nerve cells in the cochlea, leading to sensorineural hearing loss[16]. In sensorineural hearing loss, bone conduction and air conduction hearing are both decreased. Therefore, in elderly individuals, even if air conduction is improved by cerumen removal, hearing does not improve. As a result, the air-bone gap values may not be effected.

Mean air conduction hearing level in our subjects was 32.3 dB, corresponding to slight hearing impairment based on World Health Organization criteria. Compared with hearing levels of 40–50 dB reported in 80-year-old individuals[17-19], hearing levels were relatively well maintained in our population. Speech discrimination rates were 77.4%, representing a high hearing level compared to the mean of 60% reported in 80-year-olds[13]. These findings were probably influenced by our population with normal cognitive levels and MMSE score ≥21. Views on the relationship between cognitive levels and hearing levels in elderly individuals have not been clearly formulated[20], but we surmise that decreased attention, concentration, and response rates due to diminished cognitive ability influence audiometric data. To confirm the effects on hearing by cerumen removal in elderly individuals requiring care, testing methods based on decreased cognitive function and studies targeting populations with hearing levels adjusted for age are necessary. In addition, reductions in speech sound hearing can make understanding conversation difficult and impair activities of daily living[13]. The influence of cerumen removal on speech sound hearing thus needs to be investigated.

2. Relationship of earwax type to cerumen accumulation

With regard to cerumen accumulation before the start of cerumen removal, wet-type earwax accounted for most cases of complete occlusion and half occlusion. Compared to dry-type earwax, earwax accumulation was more severe. Moreover, the 5 ears that were completely occluded by cerumen all had wet-type earwax, and from 6 to 10 weeks required complete removal of cerumen. Our results resemble the findings from a study by Suehiro et al.[8] identifying wet-type earwax as a cause of earwax accumulation. This is because, compared to dry-type earwax, wet-type earwax displays a higher content of proline, a natural moisturizing factor[21], and is more viscous, thus accumulating more easily. In addition, elderly individuals show longer epidermal turnover time, decreased apocrine sweat gland function, and decreased chewing and jaw movements due to tooth loss, thus promoting cerumen accumulation. Wet-type earwax thus accumulates more easily among elderly individuals requiring caregiving, and cerumen removal is more difficult when complete occlusion occurs.

In ears where the EAM was completely occluded with wet-type earwax, cerumen could be completely removed in 6–10 weeks. This was based on set standards for cerumen removal in this study (Table 1), in which the EAM was examined every 2 weeks, with cerumen removed little by little when movement of cerumen into the cartilaginous EAM was confirmed. As a result, cerumen removal was safely accomplished. The EAM[22] is a gradual S-shaped tube, with a diameter of about 0.8 cm and a length of around 3 cm, extending from the pinna to the tympanic membrane (eardrum). When examining the EAM, gently pulling the pinna upwards is important for visualization using an otoscope. Limiting cerumen removal to the cartilaginous EAM is also an important point to prevent injury to the EAM. The cartilaginous EAM represents the outer third of the EAM, as a cartilaginous structure covered by skin contiguous with skin of the pinna. The osseous EAM represents the inner two-thirds of the EAM, as a bony structure covered by thin skin contiguous with the outer layer of the tympanic membrane. Compared to the cartilaginous EAM, the bony EAM is more susceptible to injury from external trauma. Cerumen must therefore be removed using a safe technique, based on knowledge of EAM anatomy and physiology.

However, when the EAM is completely occluded by cerumen, tympanic membrane perforation[3] or abnormality of the EAM may not be apparent. Therefore, when a nurse performs cerumen removal, in addition to examining for EAM discharge (otorrhea) and tympanic membrane perforation, a careful otolaryngologic history[1] is also important. Notable features can include vertigo, which may be a symptom of tympanic membrane perforation, and hearing loss from a younger age.

The cerumen accumulation time, namely, the time require to go from unoccluded to at least one-third occluded regardless of wet- or dry-type earwax, was about 8 weeks. Compared to reports of cerumen removal every 4 weeks in bedridden subjects[9], this time was twice as long. Earwax is usually excreted from the EAM with jaw movements such as chewing[23]. In our study, subjects maintained activities of daily living and oral intake of meals, so the period required for cerumen accumulation was probably longer.

3. Research limitations and future issues

Among elderly persons requiring institutional care, this study targeted those with normal cognitive levels and MMSE score ≥21, so the number of subjects analyzed was small. Most elderly individuals who require care have decreased cognitive function; therefore, it is necessary to conduct experimental research on individuals with decreased cognitive function. Given this situation, research targeting the entire elderly population needing care would require expanded eligibility criteria. With a 12-week intervention period for cerumen removal, the number of subjects with cerumen accumulation during this time was small. A study of cerumen accumulation over a longer period of time is thus also needed.

Conclusions

To investigate the effects of cerumen removal in elderly individuals requiring care, nurses removed cerumen over a 12-week period from 19 ears of 10 institutionalized elderly subjects. Changes in hearing and the relationship of earwax type to cerumen accumulation were evaluated. The following 4 findings were observed:

1. About 40% of ears showed severe cerumen accumulation causing half occlusion or complete occlusion.
2. In ears with severe cerumen accumulation, that is, half occlusion or complete occlusion, cerumen removal improved air conduction hearing and the air-bone gap.
3. Compared to dry-type earwax, wet-type earwax accounted for a higher rate of severe cerumen accumulation, suggesting wet-type earwax as a factor in cerumen accumulation.
4. The time required for cerumen accumulation in the EAM did not differ based on earwax type. The time for accumulation to half occlusion or one-third occlusion was about 8 weeks.

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施設高齢者における耳垢除去の効果
－聴力および耳垢の性状と蓄積との関係－

末弘　理恵

要　　旨

目的：施設高齢者における12週間の耳垢除去の効果を明らかにするため、看護職が行う耳垢除去による聴力の変化および耳垢の性状と蓄積経過との関係を明らかにする。
方法：対象は、外耳道に異常がなく、MMSE21点以上および聴力検査が可能な10名19耳である（聴力検査不可１耳は除外した）。耳垢除去は、12週間２週毎の外耳道の観察と、耳垢によって外耳道が１／２以上閉鎖した場合に軟骨部外耳道の耳垢を除去した。聴力は、気導・骨導聴力レベル（四分法）より気骨導差を算出した。耳垢蓄積は４段階、耳垢の性状は湿型と乾型に分類した。
結果：耳垢除去介入開始時、耳垢により１／２閉鎖もしくは完全閉鎖の外耳道は７耳36.8%であった。これらの７耳は、12週間後において、‘１／２閉鎖’と‘１／３閉鎖’各１耳、‘閉鎖なし’が５耳となった。耳垢除去前後に聴力検査を行った10耳のうち、「完全閉鎖→完全閉鎖」１耳を除外した９耳において、除去前に比べて除去後の閾値が有意に低下し聴力改善が示された（気導聴力：前35.4dB＞後32.8dB P=0.043、気骨導差：前5.8dB＞後2.8dB、P=0.002、t検定）。湿型耳垢（８耳）は乾型耳垢（11耳）より、１／２閉鎖および完全閉鎖の耳垢蓄積の割合が有意に高かった（P=0.001、CramérのV検定）。耳垢の蓄積期間は、「閉鎖なし→１／３閉鎖・１／２閉鎖」が約８週であり、性状の差はなかった。
考察：耳垢除去の効果として、聴力改善が示唆された。また、湿型耳垢は乾型耳垢より蓄積しやすいことが示された。看護職が行う耳垢除去は、外耳道の観察が必要であり、これが耳垢蓄積の予防につながると考える。