

Original Research Article

Prevalence, Management Modalities and Outcome of Impacted Cerumen among Patients Attending a Tertiary Hospital in Northern Tanzania

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Abstract: Background: Cerumen is a natural substance secreted by sebaceous and ceruminous glands in the outer third of the external auditory canal (EAC). It serves by preventing infections, moisturizing the ear canal, and acting as a barrier against insects and water. Impacted cerumen affects approximately 6% of the general population, 10% of children, and over 30% of the elderly. Symptoms of impacted cerumen include tinnitus and hearing loss. In children, it can hinder language and speech development, while in adults, it can lead to depression, embarrassment, career limitations, and occupational stress. Treatment methods for impacted cerumen include the use of cerumenolytics (e.g., 3% hydrogen peroxide), syringing, manual removal, and microsuction under microscopic guidance. **Objectives:** This study intends to determine the prevalence of impacted cerumen in patients attending the ENT department, describe the management modalities of impacted cerumen and determine the outcomes of management of impacted cerumen. **Methodology:** A cross-sectional, hospital-based study was conducted for six months from December 2022 to May 2023. All patients attending Ear nose and Throat (ENT) clinic were included. Participants with impacted cerumen were consented and assessed using a structured questionnaire, followed by audiological examination with pure tone audiometry. Management outcomes were recorded immediately and on seventh day post-treatment. Data were analyzed using SPSS version 25.0, and audiometric data compared using an unpaired sample t-test. **Results:** The study included 1,717 participants, of whom 161 had impacted cerumen, with median age of 19 years (IQR: 12-28 years). Those over 50 years old were 85, (52.8%), and 82 (50.9%) were males. The prevalence was 9.4%. Treatment methods included microsuction 53.4%, manual removal under microscopic guidance 11.2%, and a combination of microsuction and cerumenolytics 35.4%. There was a significant improvement in symptoms following cerumen removal ($p < 0.001$). **Conclusion:** This study sheds light on the prevalence, management modalities, and outcomes of impacted cerumen among patients. Thorough otological examinations and adherence to treatment guidelines are essential to improve patient outcomes and quality of life.

Keywords: External Auditory Canal, Microsuction, Cerumenolytics, Audiogram.

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INTRODUCTION

Background:

Cerumen, commonly known as ear wax, is a natural substance secreted by sebaceous and ceruminous glands in the outer third of the EAC. It provides several protective functions, including bactericidal effects, moisturizing the ear canal, and acting as a barrier against insects and water. Impacted cerumen affects

approximately 6% of the general population, 10% of children, and more than 30% of the elderly. Impacted cerumen is an accumulation of cerumen that causes symptoms or prevents assessment of the ear canal, tympanic membrane, or audiovestibular system. The incidence of ear wax impaction is particularly high among the elderly and individuals with intellectual disabilities [1–5].

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Risk factors for cerumen impaction include the properties of the wax (e.g., hard or dry wax) and anatomical variations such as a stenotic or narrow EAC, which is common in children and excessive hair in the EAC often seen in the elderly. Physical barriers, such as the use of cotton buds, earplugs, and hearing aids, can push ear wax further into the canal. Dermatological conditions like seborrheic dermatitis, psoriasis, and eczema also contribute to the risk. Head and neck radiation can increase the likelihood of dry cerumen due to osteoradionecrosis of the temporal bone or EAC. Additional factors include solitary osteomas and diffuse exostoses in the EAC, which can disrupt the ear's normal self-cleansing process [1–7]. Surgical interventions, such as previous tympanoplasty, myringoplasty, mastoidectomy, or canaloplasty, can also increase the risk of cerumen impaction [2].

Cerumen, along with debris and foreign bodies, is normally expelled through jaw movements. Excessive buildup can cause impaction in the EAC, leading to discomfort, tinnitus, and conductive hearing loss. Other symptoms include itching, fullness, otalgia, odor, cough, or vertigo. Severe blockage can hinder examination of the ear canal and audiovestibular system, assessable via audiometric findings. In the UK, around 2.3 million people seek treatment annually for impacted cerumen [2–5].

In children, cerumen-related hearing loss impedes language and speech development, restricting educational and vocational achievements and potentially increasing violence risk due to wrongly being counted to be arrogant. Previous studies highlight its association with poorer school performance [8]. In adults, hearing loss can lead to depression, embarrassment, social stigma, relationship challenges with partners and children, psychological distress, limited career options, and occupational stress. The World Health Organization (WHO) attributes 60% of hearing loss cases in developing countries is due to insufficient preventive measures [8, 9]. Cerumen impaction cause the least hearing loss at 0.25 kHz, and the highest at 8 kHz. Further analysis comparing PTA at 2 low frequencies (PTA0.25-0.5kHz), and 2 high frequencies (PTA6–8kHz) [10]. Different literatures set different criteria for normal hearing. The American Speech-Language-Hearing Association defines HL as hearing thresholds greater than 15 dB Hearing Level (dB HL) [9]. However, according to WHO, PTA classifications for HL are classified as **Normal Hearing**- thresholds of 0 to 25 dB HL, **Mild Hearing Loss**- 26 to 40 dB HL, **Moderate HL**- 41 to 55 dB HL, **Moderately Severe HL**- 56 to 70 dB HL, **Severe HL**- 71 to 90 dB HL and **Profound HL**- thresholds greater than 90 dB HL.

Treatment options for impacted cerumen include cerumenolytic agents such as 2.5% acetic acid, 3% hydrogen peroxide, carbamide peroxide, almond oil, or mineral oil. Methods like syringing (irrigation),

manual removal, and microsuction under microscope guidance are also utilized. Syringing is considered risky due to unpredictable water pressure that may cause tympanic membrane (TM) perforation and damage to other middle ear structures. While microsuction is generally safe and preferred by most ENT practitioners, concerns exist among some audiologists regarding the noise produced by the suction tip, which could potentially lead to temporary or permanent hearing loss [2-6]. Using cerumenolytics before microsuction was more effective than no softening, also reduce pain and vertigo [7]. Persistent symptoms after cerumen removal may require further investigation for alternative diagnoses [2-5]. Patients with coagulopathies (e.g., hemophilia, thrombocytopenia), hepatic failure, or those using anticoagulant medications should be counseled about the risk of bleeding from the EAC [5].

METHODOLOGY AND MATERIALS

Study Design and Time

This was a six-month cross-sectional hospital-based study conducted from December 2022 to May 2023.

Study Area: ENT Department at KCMC

Study Population

The study enrolled all patients aged 7 years and older presenting with otolaryngological conditions at the ENT Clinic of KCMC Zonal Referral Hospital during the study period from December 2022 to May 2023.

Eligibility Criteria

Inclusion Criteria:

Patients aged 7 years old and above diagnosed with impacted cerumen through clinical assessment at the Tertiary Hospital in Northern Tanzania during the study period were included, provided they or their legal guardians gave informed consent.

Exclusion Criteria:

Patients without clinically confirmed impacted cerumen, those unable to understand study procedures or provide informed consent due to language barriers, individuals with incomplete medical records or missing key information, and patients with concurrent otological conditions needing immediate intervention other than impacted cerumen management.

Sample Size and Sampling Technique

The sample size was determined based on estimated prevalence rates of impacted cerumen among patients attending the Tertiary Hospital in Northern Tanzania (Bastos *et al.*, 1995; Brkić, 2010; Michaudet and Malaty, 2018). A cross-sectional design was used to assess prevalence, management approaches, and outcomes. Convenience sampling was employed to select participants meeting inclusion criteria from December 2022 to May 2023. Ethical approval number PG 120/2022 was obtained from Clinical Research

Ethical Committee, and informed consent was obtained from all participants or their guardians.

STUDY VARIABLES

Independent variables:

These include demographic information as age, sex, occupation, and socioeconomic status of patients. Clinical characteristics including duration and severity of symptoms, type of cerumen (dry or wet), and associated symptoms (e.g., pain, tinnitus, hearing loss); medical history comprising of presence of comorbidities, history of ear infections, previous ear surgeries, and use of hearing aids.

Dependent Variables:

These include the prevalence of impacted cerumen, defined as the proportion of patients diagnosed with the condition, the management modalities employed, such as cerumenolytics, syringing, manual removal, and microsuction, and the outcomes of these management approaches, including symptom resolution, complications, and hearing improvement post-treatment.

DATA COLLECTION METHODS, TOOLS, AND STUDY PROCEDURES

All patients aged 7years old and above underwent otomicroscopic examination using a Zeiss® microscope (Germany). Those with impacted cerumen were initially assessed for symptoms using a pre-tested structured questionnaire. Audiological evaluation was then performed using Pure Tone Audiometry (PTA) with an Interacoustics™ AC-40 clinical audiometer

(Denmark), assessing both low and high frequencies (LPTA and HPTA), ranging from 250 to 8000Hz respectively. For patients with hard impacted cerumen, hydrogen peroxide 3% ear drops (4 drops in each ear twice daily for 5 days) were prescribed, followed by microsuction with a MediTop™ MT1000 device (Netherlands). Patients were reassessed for otological symptoms 30 minutes after impacted cerumen removal and again one week later, using the same questionnaire and PTA. Consistency was maintained in the use of cerumenolytics and equipment throughout the study. Data collection involved pre-tested coded structured questionnaires, otological examinations, and PTA.

Data Management and Analysis Plan

Data were entered, processed, and analyzed using SPSS version 25. After cleaning the data, new variables were created and categorized as needed. Descriptive statistics were summarized using frequencies and proportions for categorical variables, while medians and interquartile ranges (IQR) were used for continuous variables. A T-test with a 95% confidence interval was conducted to compare mean hearing frequencies before and after cerumen removal. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Characteristics of the Study Participants

Study included 1717 participants who attended the ENT clinic. The details are as presented in Table 1.

Table 1: Characteristics of study participants with impacted cerumen (n=161)

Characteristics	n (%)
Age (years) (median (IQR))	19.0 (12.0 - 28)
Age (years)	
7 - 17	14 (8.7)
18 - 28	21 (13.0)
29 - 39	24 (14.9)
40 - 50	17 (10.6)
>50	85 (52.8)
Sex	
Male	82 (50.9)
Female	79 (49.1)
Occupation	
Student	30 (18.6)
Peasant	69 (42.9)
Employed	26 (16.2)
Self employed	26 (16.2)
Retired	10 (6.1)

The Prevalence of Impacted Cerumen among Patients Attended at KCMC in Northern Tanzania

The overall prevalence of impacted cerumen among the study participants was 9.4%, with 161 individuals affected. Among these, 21 (13.0%) had impacted cerumen in the right ear, 28 (17.4%) in the left ear, and 112 (69.6%) in both ears.

The Management Modalities of Impacted Cerumen for Patients Attended at KCMC in northern Tanzania. Among patients with impacted cerumen attended the hospital, management modalities varied as presented in figure 1.

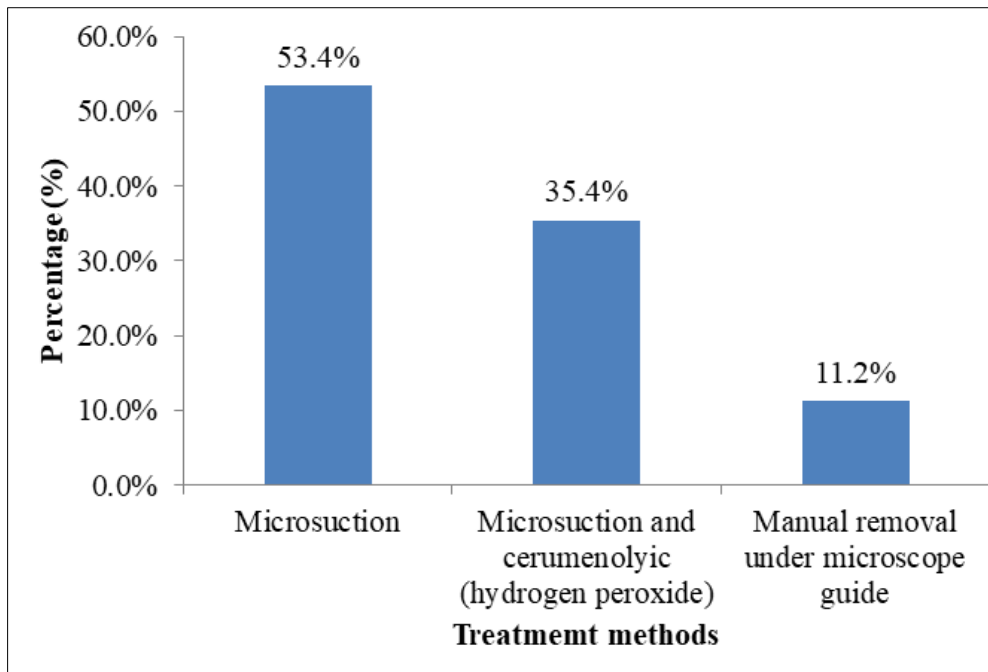


Figure 1: The management modalities of impacted cerumen (n=161)

The Outcomes of Impacted Cerumen Management among Patients Attended at KCMC Hospital in Northern Tanzania

After cerumen removal, changes in symptoms presence were observed. However, those who still

experienced symptoms showed improvement compared to their condition before cerumen removal. See Table 2 for details.

Table 2: Symptoms before and after cerumen removal (n=161)

Symptoms	Cerumen removal		Symptoms after management		
	Before	After	Same	Better	Worse
	n (%)	n (%)	n (%)	n (%)	n (%)
Tinnitus					
Absent	47 (29.2)	142 (88.2)			
Present	114 (70.8)	19 (11.8)	2 (10.5)	17 (89.5)	0 (0.0)
Vertigo					
Absent	119 (73.9)	154 (95.6)			
Present	42 (26.1)	7 (4.4)	0 (0.0)	7 (100.0)	0 (0.0)
Ear pain					
Absent	78 (48.4)	137 (85.1)			
Present	83 (51.6)	24 (14.9)	7 (29.2)	16 (66.7)	1 (4.2)
Ear itching					
Absent	53 (32.9)	110 (68.3)			
Present	108 (67.1)	51 (31.7)	15 (29.4)	34 (66.7)	2 (3.9)
Ear fullness					
Absent	24 (14.9)	148 (91.9)			
Present	137 (85.1)	13 (8.1)	3 (23.1)	10 (76.9)	0 (0.0)
Cough					
Absent	101 (62.7)	137 (85.1)			
Present	60 (37.3)	24 (14.9)	10 (41.7)	14 (58.3)	0 (0.0)
Imbalance					
Absent	115 (71.4)	153 (95.1)			
Present	46 (28.6)	8 (4.9)	2 (25.0)	6 (75.0)	0 (0.0)
Dizziness					
Absent	122 (75.8)	156 (96.9)			
Present	39 (24.2)	5 (3.1)	2 (40.0)	3 (60.0)	0 (0.0)

Symptoms	Cerumen removal		Symptoms after management		
	Before	After	Same	Better	Worse
	n (%)	n (%)	n (%)	n (%)	n (%)
Cognitive impairment					
Absent	115 (71.4)	157 (97.5)			
Present	46 (28.6)	4 (2.5)	4 (100.0)	0 (0.0)	0 (0.0)
Frequent request for repetition					
Absent	36 (22.4)	156 (96.9)			
Present	125 (77.6)	5 (3.1)	3 (60.0)	2 (40.0)	0 (0.0)
Inattentiveness					
Absent	109 (67.7)	157 (97.5)			
Present	52 (32.3)	4 (2.5)	2 (50.0)	1 (25.0)	1 (25.0)
Distorted speech					
Absent	131 (81.4)	161 (100.0)			
Present	30 (18.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Regarding hearing outcomes, a significant number of study participants showed improvement from

profound or severe hearing loss to normal or better hearing. See Table 3 for details.

Table 3: Hearing frequency before and after cerumen removal (n=161)

Hearing frequencies	Cerumen removal	
	Before	After
	n (%)	n (%)
HPTA right		
Normal	27 (16.8)	53 (32.9)
Mild	27 (16.8)	32 (19.9)
Moderate	35 (21.7)	23 (14.3)
Moderate severe	26 (16.2)	28 (17.4)
Severe	45 (27.9)	25 (15.5)
Profound	1 (0.6)	0 (0.0)
HPTA left		
Normal	20 (12.4)	43 (26.7)
Mild	21 (13.0)	37 (22.9)
Moderate	28 (17.4)	19 (11.8)
Moderate severe	32 (19.9)	26 (16.2)
Severe	59 (36.7)	36 (22.4)
Profound	1 (0.6)	0 (0.0)
LPTA Right		
Normal	49 (30.4)	94 (58.4)
Mild	53 (32.9)	44 (27.3)
Moderate	36 (22.4)	15 (9.3)
Moderate severe	15 (9.3)	5 (3.1)
Severe	8 (4.9)	3 (1.9)
Profound	0 (0.0)	0 (0.0)
LPTA left		
Normal	38 (23.6)	87 (54.0)
Mild	69 (42.9)	41 (25.5)
Moderate	31 (19.2)	25 (15.5)
Moderate severe	15 (9.3)	6 (3.7)
Severe	8 (4.9)	2 (1.2)
Profound	0 (0.0)	0 (0.0)

HPTA, High Pure Tone Audiometry; LPTA, Low Pure Tone Audiometry

There was a significant mean difference in the hearing frequency between before cerumen removal and

after cerumen removal ($p < 0.001$). This is shown in Table 4.

Table 4: The mean hearing frequency before and after cerumen removal (n=161)

Hearing frequency (dB)	Cerumen removal				t-test	p-value
	Before		After			
	Mean (SD)	95% CI	Mean (SD)	95% CI		
LPTA right	38.2 (17.4)	35.5 - 40.9	29.6 (14.2)	27.3 - 31.8	4.888	<0.001
LPTA left	39.3 (15.9)	36.9 - 41.8	30.8 (14.3)	28.6 - 33.0	5.061	<0.001
HPTA right	55.5 (24.2)	51.7 - 59.3	44.3 (24.2)	40.6 - 48.1	4.144	<0.001
HPTA left	60.7 (23.7)	57.0 - 64.4	47.8 (24.9)	43.9 - 51.7	4.758	<0.001

HPTA, High Pure Tone Audiometry; LPTA, Low Pure Tone Audiometry

DISCUSSION

Prevalence of Impacted Cerumen

The prevalence of impacted cerumen varies globally, influenced by geographical, demographic, and healthcare access factors. Our study at KCMC found a prevalence of impacted cerumen of 9.4% among patients, which is consistent with previous findings in Tanzania [6]. Studies conducted in Monduli and Moshi reported similar rates, highlighting the prevalence among children and disparities between rural and urban areas [6]. These differences underscore the impact of healthcare infrastructure and hygiene practices on cerumen-related conditions.

Management Modalities of Impacted Cerumen

Management strategies for impacted cerumen involve various approaches tailored to patient safety and efficacy. Methods include syringing/irrigation, manual removal, cerumenolytics, and microsuction. Microsuction emerged as a preferred method in our study due to its safety profile, especially when preceded by cerumenolytic preparation. This approach is consistent with findings from studies in the United Kingdom emphasizing the effectiveness of microsuction while noting safety concerns associated with other methods such as syringing [2].

Outcome of Impacted Cerumen Management

Impacted cerumen presents with a range of symptoms, including ear discomfort, tinnitus, and hearing loss, with potential complications like tympanic membrane perforation. Following cerumen removal, significant symptom relief was observed, with improvements noted in symptoms like vertigo and ear pain⁴. Hearing outcomes also showed substantial improvement, underscoring the therapeutic benefits of timely and appropriate cerumen management in enhancing patient quality of life and auditory health.

Limitations of the Study

The study's limitations include potential selection bias due to its focus on patients attending a single tertiary hospital, which may not fully represent the broader population with impacted cerumen. This could limit the generalizability of findings beyond the specific demographic and geographic context of Northern Tanzania. While the sample size was adequate for the study's scope, it may restrict the ability to detect fewer common outcomes or associations. The short one-week

follow-up period may not capture long-term outcomes or recurrence of impacted cerumen. Data collection relying on self-reported symptoms and medical records could introduce information bias, affecting data accuracy and completeness. Variability in individual responses to cerumen removal techniques and treatments could also impact the consistency of outcomes observed. Future research should address these limitations to strengthen understanding of impacted cerumen management and outcomes.

CONCLUSION

This study sheds light on the prevalence, management modalities, and outcomes of impacted cerumen among patients at a tertiary hospital in Northern Tanzania. Impacted cerumen was found to be prevalent among a significant proportion of patients, particularly affecting the elderly, who often cannot express their symptoms early. Microsuction emerged as the preferred and safer method for removing cerumen, especially when preceded by the use of cerumenolytics. This approach facilitates the removal process and minimizes complications, such as injury to the external auditory canal and tympanic membrane.

The study demonstrated notable improvements in symptoms, including hearing loss and tinnitus, following cerumen removal. These findings underscore the importance of timely intervention and comprehensive otological care. Clinicians are urged to conduct thorough examinations, adhere to established guidelines, and ensure follow-up care to enhance patient well-being and quality of life. Additionally, if symptoms persist after cerumen removal, further investigations should be conducted to rule out alternative diagnoses, ensuring holistic management and optimal outcomes for patients.

Recommendations

This study highlights the need for enhanced screening and early detection of impacted cerumen, particularly among the elderly, to prevent complications and improve outcomes. Microsuction, especially when used with cerumenolytics, should be promoted as the primary removal method due to its safety and effectiveness. Comprehensive otological assessments and follow-up care are essential for monitoring patient progress and addressing persistent symptoms. Educating patients and caregivers about impacted cerumen can lead to earlier treatment and reduce complications. We

recommend further research to explore alternative management methods and long-term outcomes. Policies should support standardized, effective cerumen management techniques, and healthcare providers should receive ongoing training on best practices. A holistic approach to patient management is crucial, with prompt investigation of alternative diagnoses if symptoms persist post-treatment. Clinicians should employ gentle techniques to minimize the risk of traumatic removal of impacted cerumen.

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