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Otomycosis among Patients Presenting with Ear Discharges at a Tertiary Hospital in South Western Uganda

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Authors' contributions

This work was carried out in collaboration between all authors. Author HI originated and designed the study, wrote the protocol, managed literature search, collected and analysed data and wrote the first draft of the manuscript. Author VK analyzed the data, performed the statistical analysis and reviewed manuscript drafts. Author VN collected data. Authors JSI, MN, BM, JMK, JB and FB wrote and reviewed manuscript drafts. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To determine prevalence, mycology profile, associated symptoms and risk factors of otomycosis among patients that present with an ear discharge.

Study Design: This was a cross-sectional study in which survey data was analysed.

Place and Duration of Study: Departments of Microbiology and ENT, Faculty of Medicine, Mbarara University Teaching Hospital, between 2013 and 2015.

Methodology: We recruited 117 patients (52 men, 65 women of age range 1-69 years) presenting with a discharging ear. Both newly enrolled and follow-up patients were included in the study. Clinically, patients were assessed for symptoms, possible predisposing factors, and treatment history. For laboratory diagnosis, ear swabs were aseptically collected and mycology profile determined using both direct examination and culture techniques. Fungal identification was through stimulation of fruiting bodies such as conidia or chlamydo-spores and biochemical identification.

Results: Of the 117 participants enrolled, fungal infection was detected in 24 (20.51%) with direct microscopy and confirmed in 16 (13.68%) by culture. Otomycosis was more common among the youth (54%). There were no statistically significant symptoms associated with otomycosis. However, HIV/AIDS and mastoidectomy were significant predisposing factors (38%, $p = 0.001$ and 25%, $p = 0.002$, respectively). *Aspergillus species* (76.47%), *Candida albicans* (17.65%) and *Cladosporium species* (5.88%) were the agents commonly associated with otomycosis in this region.

Conclusion: Otomycosis can be common and is an important disease of the external ear, especially in at-risk individuals. In southwestern Uganda, the disease is common among young males and aetiology is mainly due to *Aspergillus* and *Candida albicans* but other opportunists such as *Cladosporium species* may also be implicated. Thus, there is a need for routine checks followed by robust diagnostic approaches as a means for evidence-based patient management.

Keywords: Otomycosis; ear discharge; fungi; *Aspergillus*; *Candida*; *Cladosporium*.

1. INTRODUCTION

Otomycosis is a fungal infection of the external auditory canal [1-4]. The infection can develop as a super-imposed secondary infection alongside bacterial otitis. It is very common in the sub-tropical regions and usually presents as an acute, sub-acute or chronic inflammation with relatively mild but very damaging symptoms such as otorrhea, otalgia, scaling, pruritis, discomfort, malodorous discharge, and hearing loss [1,2,5-7]. On the other hand, a discharging ear can also increase the risk of contracting otomycosis, as ear exudate can trap airborne fungal propagules and subsequently act as a nutrient source for saprophytic fungi. In addition, there are several other risk factors for otomycosis including but not limited to bacterial otitis, seborrheic dermatitis, diabetes, eczema, HIV/AIDS, warm temperatures, and certain behaviours including swimming and, recently, headphone usage [2,4, 6,7]. Accordingly, otomycotic infections need to be differentiated from other causes of ear diseases. This is because common symptoms associated with ear disease are often not specific to otomycosis, especially in patients that present with ear discharge. Furthermore, the main aetiological agents of otomycosis often reported are saprophytic fungi such as *Aspergillus species* [8-12]. This calls for extra vigilance during clinical management and laboratory diagnosis as these can easily be mistaken for contamination. Thus, it is important that aetiology, risk factors, and symptoms associated with otomycosis be evaluated in order to improve prognosis in these

cases. In this study, therefore, we employed basic mycological techniques to survey and determine the prevalence, mycological profile, symptoms, and predisposing factors of otomycosis among patients presenting with ear discharges at a tertiary hospital in the southwestern region of Uganda.

2. MATERIALS AND METHODS

2.1 Patients

This was a cross sectional study that recruited 117 patients. Only patients presenting with an ear discharge attending Ear Nose and Throat (ENT) clinic for the first time or on follow up treatment at the time of recruitment were included in the study. Patient profiles were captured using a questionnaire, and the data checklist included demographic information, treatment history (such as antibiotic, non-sterile oils, or antifungal usage), symptoms (such as itching, otorrhea, blockage, pain, or burning sensations) and possible predisposing factors (such as HIV/AIDS, mastoidectomy, diabetes, pregnancy, and ear manipulation with objects).

2.1.1 Mycology examination

Ear swabs were aseptically collected and processed both for direct examination and fungal culture. Smears for both Gram staining and 20% potassium hydroxide (KOH) wet mount were prepared and examined. For fungal isolation,

samples were primarily cultured on sabouraud dextrose agar (SDA) (-/+ antibiotics), incubated at 25°C and 37°C for 2-4 weeks, and evaluated every 2-3 days. Positive fungal colonies were further sub-cultured on potato dextrose agar (PDA) or cornmeal agar (CMA) at 25°C and 37°C for 2-4 weeks to stimulate fruiting. Definitive diagnosis of otomycosis was determined based upon presence or absence of fungal elements in a direct examination and/or microscopic identification of the characteristic structural fungal fruiting bodies for filamentous fungi and yeasts on CMA. Analytical profile index (API) was also performed on yeast isolates.

2.2 Data Analysis

Data were analyzed using GraphPad prism. Percentages and confidence interval of 95% were used for categorical variables. Quantitative data are presented as mean ± standard deviation, Chi-square tests for binary outcomes were also performed, and $p < 0.05$ were considered statistically significant.

3. RESULTS AND DISCUSSION

3.1 Demographic Distribution

The study recruited a total of 117 patients that presented with ear discharge during the enrollment period. Females (55.56%) were more common amongst the participants. Children (32.48%) and youths (33.33%) were the most common age groups to present with ear discharges (Table 1).

3.2 Otomycosis Cases by Age, Gender, Mycological Profile, Predisposing Factors, Treatment History and Symptoms

Direct examination of samples showed more sensitivity when compared with culture results (Table 2). However, combining results for both techniques, the highest prevalence of otomycosis was seen among youths (14; 58.33%) and among male participants (15; 62.50%) (Table 2). Where possible, likely predisposing factors and treatment history were recorded. We observed that HIV/AIDS (6; 25.00%) and mastoidectomy (5; 20.83%) were the most common predisposing factors. Treatment history revealed that most of the patients (17; 70.83%) had an extended history of repeated treatment with antibiotics (Table 2). The most prevalent symptoms among

these patients were itching (14; 58.33%), reduced hearing (3; 12.5%), or a combination of otorrhea and itching (2; 8.33%). Other symptoms of otomycosis occurred in equal measures of (1; 4.17%) with exception of burning sensation (0; 0.00%) (Table 2).

Table 1. Demographic data

Variable	Number (%)
Age* groups (years)	
Children (1-13)	38(32.48)
Adolescents (14-17)	13(11.11)
Youth (18-34)	39(33.33)
Middle aged (35-64)	23 (19.66)
Elderly (>64)	4(3.42)
Total	117 (100%)
Gender	
Male	52(44.44)
Female	65(55.56)
Total	117 (100%)

3.3 Aetiology of Otomycosis

The aetiologies of the observed otomycoses were primarily *Aspergillus fumigatus* (8; 47.06%), *Aspergillus flavus* (4; 23.53%), *Candida albicans* (3; 17.65%), *Aspergillus niger* (1; 5.88%) or *Cladosporium* species (1; 5.88%) as demonstrated in Fig. 1.

3.4 Discussion

Although the majority of otomycoses occur as secondary infections in the context of other diseases, the consequences of these infections for patient quality of life can no longer be ignored. Otomycoses are common among patients that present with ear diseases, with an estimated incidence of between 5-80% worldwide [13,14]. In this study we report the prevalence of otomycosis to be 20.51% in patients that presented with ear discharges at our ENT clinic. The prevalence of 20.51% recorded here is similar to many other studies that have reported similar figures of between 5-40% [1,2,5,13,15-19]. This is however lower than several studies that have reported higher prevalence of between 70-80% [3,6-9,12,13,20-22]. We also established that the most affected gender and age group were males and youths of age (19-45 years). This age group is consistent with many other studies, but some studies have identified females as the main victims of this infection [8,18,22,23]. This difference may be attributed to the life style and nature of work by this gender and age category. The assessment

of risk factors here revealed HIV/AIDS, mastoidectomy and diabetes as the main predisposing factors to otomycosis (Table 2). These findings are consistent with reports that immunosuppressive conditions such as malignancies, diabetes mellitus or HIV/AIDS are key predisposing factors for otomycosis [2,19, 24]. Indeed, HIV has been reported as a major risk factor for chronic ear disease, and this, in addition to the fact that south western Uganda is one of the regions with high incidence rates of HIV/AIDS in Uganda, could explain our findings here [25,26].

Other risk factors often associated with otomycosis have also included, but are not limited to, the use of cotton buds and ear drops, ear manipulation and self-cleaning [22]. Treatment history also influences manifestation of otomycosis, and others have also reported treatment history as a risk factor for this infection [8]. Here, we report that more study subjects had a history of antibacterial treatment than had a history of antifungal management (Table 2). This was not a surprising finding given the target population for the study: ear discharge can be caused by bacterial infection, prompting

antibacterial treatment. In addition, our data raise the possibility that ear diseases can be worsened by a secondary fungal infection, even when the primary aetiology is not fungal. Other confounding factors such as misdiagnosis and negligence can also be linked to this outcome.

While we observed no cases of otomycosis among participants who employed non-sterile oils as a treatment remedy, this cannot rule out oil remedies as a risk factor. Oil remedies such as mustard oil application have been highlighted by other studies as a risk factor for otomycosis [22]. On the other hand, our analysis of the symptoms associated with otomycosis revealed that most of the symptoms seen in other cases of otitis externa are also seen during otomycosis. We established itching (58.33%) and reduced hearing or blockage (12.50%) as the most prevalent symptoms (Table 2). These findings are consistent with what has been reported by other studies, but suggest that otomycosis cannot be evaluated on the basis of symptoms alone, because similar symptoms can be manifested by ear infections with non-fungal aetiology [4,5,22].

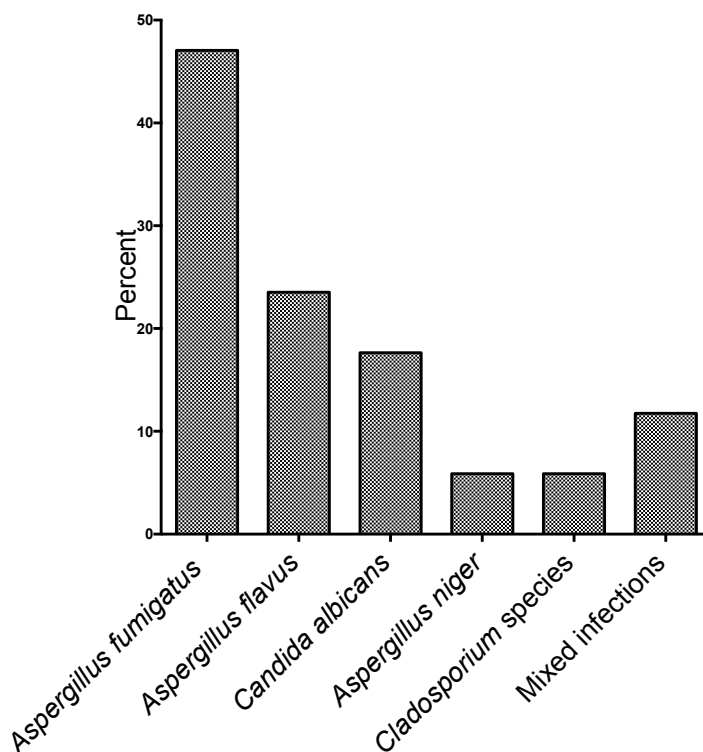


Fig. 1. Otomycosis by aetiology

Table 2. Otomycosis by age, gender, predisposing factors, treatment history, and symptoms

Variable	KOH (n=24)			Culture (n=16)		
	Proportion (%)	Odds (95% CI)	p value	Proportion (%)	Odds (95% CI)	p value
Age groups			0.0982			0.064
Children (1-12)	4 (6.67)	1		2 (12.50)	1	
Young adults (13-18)	6 (25.00)	2.9 (0.72-18.80)		3 (18.75)	2.60 (0.40-17.01)	
Youths (19-45)	14 (58.33)	3.39 (1.10-11.44)		11 (68.75)	5.19 (1.07-25.17)	
Adults (>45)	0 (0)	-		0 (0)	-	
Gender			0.0461			0.1184
Male	15 (62.50)	2.52 (1.00-6.36)		10 (62.50)	2.34 (0.79-6.94)	
Female	9 (37.50)	1		6 (37.50)	1	
Predisposing factors			0.0483			0.0015
HIV/AIDS	6 (25.00)	4.12 (1.22-13.87)		6 (37.50)	12.5 (2.96-52.85)	
HIV/AIDS and mastoidectomy	0 (0)	-		0 (0)	-	
Diabetes	1 (4.17)	2.06 (0.20-21.63)		1 (6.25)	6.25 (0.53-74.38)	
Malignancy	0 (0)	-		0 (0)	-	
Pregnancy	0 (0)	-		0 (0)	-	
Mastoidectomy	5 (20.83)	6.18 (1.53-24.91)		4 (25.00)	12.5 (2.96-52.85)	
Cleaning ears with objects	1 (4.17)	2.06 (0.20-21.63)		1 (6.25)	6.25 (0.53-74.38)	
None	11 (45.83)	1		1	1	
Treatment history			0.7802			0.7076
Antibiotics	17 (70.83)	1.04 (0.34-3.21)		9 (56.25)	0.48 (0.14-1.62)	
Antibiotics and non-sterile oils	0 (0)	-		0 (0)	-	
Antifungals	1 (4.17)	0.51 (0.05-5.22)		1 (6.25)	0.51 (0.05-5.22)	
Non-sterile oils	1 (4.17)	0.45 (0.04-4.50)		1 (6.25)	0.45 (0.04-0.50)	
None	5 (20.83)	1		5 (31.25)	1	
Symptoms			0.7802			0.6233
Otorrhea	1 (4.17)	1		0 (0)	-	
Otorrhea & itching	2 (8.33)	0.2 (0.01-4.72)		1 (6.25)	1	

Variable	KOH (n=24)			Culture (n=16)		
	Proportion (%)	Odds (95% CI)	p value	Proportion (%)	Odds (95% CI)	p value
Otorrhea & blockage	1 (4.17)	1		1 (6.25)	1	
Itching	14 (58.33)	0.43 (0.04-50.9)		10 (62.50)	7.00 (0.30-162.2)	
Itching & pain	1 (4.17)	1		0 (0)	-	
Itching & blockage	1 (4.17)	1		1 (6.25)	1	
Itching, pain & blockage	0 (0)	-		0 (0)	-	
Pain	1 (4.17)	1		1 (6.25)	1	
Burning sensation	0 (0)	1		0 (0)	-	
Burning sensation & blockage	0 (0)	1		0 (0)	-	
Reduced hearing (blockage)	3 (12.50)	0.46 (0.03-6.93)		2 (12.50)	1.01 (0.20-5.14)	

Finally, we also report here that otomycosis aetiology is dominated by Aspergilli species (Fig. 1). We particularly recorded *Aspergillus fumigatus* as the most prevalent species. Other aetiological agents included *Candida albicans* and *Cladosporium* species. These findings are consistent with other studies that name *Aspergillus* species as the most common aetiological agents of otomycosis. However, whereas *A. niger* is widely reported as the most prevalent cause, we most frequently identified *A. fumigatus* [2,5,6,8,10,12,13,18,23,24,27-29]. As for the non-*Aspergillus* isolates, we established *C. albicans* as the third most common isolate, consistent with the published literature [14,18,27,29,30]. To our knowledge, ours is the first study to associate *Cladosporium* species with otomycosis. *Cladosporium* was observed in a single patient, compared to three patients diagnosed with *C. albicans*. This patient had a history of mastoidectomy, and our recent laboratory records show an increase in the prevalence of dematiaceous fungi such as *Cladosporium* species among patients with history of trauma in this region (unpublished data). Dematiaceous fungi are generally environmental opportunists that can contaminate wounds, and a discharging ear would be a suitable niche for such fungal organisms. Additionally, we also found mixed fungal infections in 11.76% of the patients, similar to findings by Agarwal and Devi [22]. Mixed fungal infection can be a common feature, especially in patients that present with hallmark underlying risk conditions.

4. CONCLUSION

Clearly, patient populations susceptible to infections such as otomycosis are generally on the increase. This study indicates that otomycosis is common among patients that present with ear discharges. It also shows that young males may suffer more from this condition compared to other groups. The disease may have several predisposing factors and can manifest with a series of rather nonspecific symptoms. Thus, identification and differentiation of otomycotic aetiology is vital for appropriate management of patients in south western Uganda. Going forward, patients that present with any of the underlying conditions and symptoms reported here should be examined for fungal aetiology. Furthermore, we also show that *Aspergillus* species remain the main aetiological agents of otomycosis in this region. However, aetiology due to other fungal agents such as

Candida albicans and *Cladosporium* species may not be uncommon.

CONSENT

Authors declare that a written informed consent was obtained from all study subjects.

ETHICAL APPROVAL

Approval for the study was obtained from Mbarara University of Science and Technology Institutional Review Committee (MUST-IRC).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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