Clinical presentation of aspergillus and candida in otomycosis: A cross-sectional study at a tertiary hospital in Central Java, Indonesia

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ABSTRACT

Introduction: Otomycosis is a common fungal infection of the external auditory canal, particularly in tropical regions. *Aspergillus* and *Candida* are the main causative agents, yet their clinical differentiation remains challenging due to overlapping manifestations. This study aimed to identify the distribution of fungal etiologies, and to compare clinical manifestations and predisposing factors between *Aspergillus* and *Candida* infections in a tertiary hospital in Central Java, Indonesia.

Materials and Methods: A cross-sectional study was conducted at a tertiary hospital, including patients aged 17 years and above with clinically and microbiologically confirmed otomycosis. Demographic data, symptoms, physical findings, and predisposing factors were collected. Fungal identification was performed using culture and microscopy. Comparative analyses were conducted using chi-square or Fisher's exact test.

Results: A total of 41 patients (56 fungal isolates) were included. Aspergillus spp. accounted for 58.9% of isolates, while Candida spp. comprised 41.1%, with mixed infections observed in 16.1%. Itching, hearing loss, and ear fullness were the most common symptoms in both groups. No statistically significant differences were found in clinical manifestations or physical examination findings between *Aspergillus* and *Candida* infections (all p>0.05). Although whitish debris was more frequent in *Candida* and brownish debris in *Aspergillus*, these patterns were not discriminatory. Ear drop use and cotton bud manipulation were significantly associated with Aspergillus infections (p<0.05).

Conclusion: Substantial clinical overlap exists between *Aspergillus* and *Candida* otomycosis, underscoring the importance of microbiological confirmation for accurate diagnosis.

KEYWORDS:
Aspergillus; candida; external ear canal; otomycosis

INTRODUCTION

Otomycosis is a fungal infection of the external auditory canal (EAC) and tympanic membrane that may present in acute, subacute, or chronic forms.[1-2] It accounts for approximately 9 - 30% of EAC infection.[2] The incidence is higher in tropical and subtropical with humid climate regions.[3-4] Although generally not life-threatening, the condition is often characterized by recurrence and may require prolonged management.[5]

The most common causative agents of otomycosis are *Aspergillus* and *Candida*.[2,4] Accurate identification of the underlying fungal etiology is clinically important. Several studies have reported reduced sensitivity to commonly used antifungal agents.[6] Early recognition of potential differences in clinical presentation may help guide more appropriate empirical therapy while awaiting microbiological confirmation.[2]

However, differentiating between *Aspergillus* and *Candida* infections based solely on clinical manifestations and predisposing factors remains challenging due to their non-specific and overlapping features. In addition, comparative data evaluating these differences are limited.[2,4,7] Regional data from Indonesia, particularly from tertiary healthcare settings, are also scarce. Therefore, this study aimed to identify the distribution of fungal etiologies in otomycosis and to evaluate differences in clinical characteristics and predisposing factors between infections caused by *Aspergillus* and *Candida* in a tertiary hospital in Central Java, Indonesia.

MATERIALS AND METHODS

Study Design, Participants, and Data Collection

This cross-sectional study was conducted at the otorhinolaryngology clinic of Margono Soekarjo General Hospital from April to September 2022. This hospital is a tertiary referral center in Central Java, Indonesia. Patients were included if they were aged 17 years and above, clinically diagnosed with otomycosis based on typical otoendoscopic findings by an otorhinolaryngologist, had fungal elements confirmed through microbiological examination, and had complete clinical and demographic data available. Patients who had received antifungal treatment prior to sampling, had contaminated specimens, or had fungal isolates other than *Aspergillus* spp. or *Candida* spp. were excluded. Data on demographic characteristics, clinical manifestations, and predisposing factors were obtained through structured patient interviews and review of medical records.

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Specimen Collection and Microbiological Examination

Ear swab specimens were obtained from patients who had been clinically diagnosed with otomycosis based on otoendoscopic examination by an otorhinolaryngologist. Following diagnosis, samples were collected from the EAC using sterile flocked swabs and transported in Amies medium to the microbiology laboratory.

All specimens were cultured on appropriate fungal media and incubated under standard conditions. Identification of fungal isolates was performed based on macroscopic colony characteristics and microscopic morphology. Direct microscopic examination was also conducted using Gram staining and 10% KOH preparation to support identification.[8]

Statistical Analysis

Data were analyzed using IBM SPSS version 25. Descriptive analysis was used to present the distribution of variables. Comparative analysis between *Aspergillus* and *Candida* groups was performed using the chi-square test or Fisher's exact test, as appropriate, with statistical significance defined as $p < 0.05$.

RESULTS

Study Population and General Characteristics

A total of 41 patients were included in this study, of whom 6 presented with bilateral involvement. Due to the presence of mixed fungal infections, an additional nine isolates were identified, resulting in a total of 56 fungal isolates (Table I). All subsequent analyses were conducted on an isolate basis.

The age of the subjects ranged from 11 to 80 years, with the highest proportion of isolates observed in the 31–40-year age group (28.6%). The mean age was 38.9 years, with a median age of 36 years. Of the 56 isolates, 51.8% (29/56) were obtained from female patients, while 48.2% (27/56) were from male patients.

The age distribution differed descriptively between fungal groups. The highest proportion of Aspergillus isolates was observed in the 31–40-year age group (27.3%), while Candida isolates were most frequently identified in the 21–30-year age group (34.0%). Regarding gender distribution, *Candida* isolates were more commonly obtained from female patients (60.9%), whereas *Aspergillus* isolates were more frequently identified in male patients (54.5%). However, these differences were not statistically significant for either age group (p=0.364) or gender (p=0.388) (Table II).

Distribution of Fungal Isolates

The distribution of fungal isolates is presented in Table I. *Aspergillus* spp. constituted the majority of isolates (58.9%, 33/56), while *Candida* spp. accounted for 41.1% (23/56). Mixed infections were identified in 16.1% (9/56) of isolates, comprising combinations of *Candida-Candida*, *Aspergillus-Aspergillus*, and *Aspergillus-Candida*. The most frequently observed mixed species combinations were *C. parapsilosis* with *C. tropicalis* and *A. flavus* with *C. parapsilosis*, each identified in two samples.

Within the *Aspergillus* group, *A. flavus* was the predominant species (48.5%, 16/33), followed by *A. niger* (27.3%, 9/33) and *A. fumigatus* (9.1%, 3/33). Other *Aspergillus* species accounted for a small proportion of isolates (3.0%, 1/33).

Within the Candida group, *C. parapsilosis* was the most frequently identified species (39.1%, 9/23), followed by *C. tropicalis* (26.1%, 6/23) and *C. krusei* (13.0%, 3/23). Less common species included *C. kefyr* (8.7%, 2/23) and other Candida species (4.3%, 1/23).

Comparison of Clinical Manifestations

The distribution of clinical manifestations according to fungal group is presented in Table III. Overall, itching was the most frequently reported symptom in both groups, observed in 78.8% of *Aspergillus* and 87.0% of *Candida* isolates. Hearing loss was reported in 78.8% of *Aspergillus* cases and 82.6% of *Candida* cases. A sensation of ear fullness was noted in 72.7% of *Aspergillus* and 73.9% of *Candida* infections.

Ear discharge was reported in 54.5% of *Aspergillus* and 65.2% of *Candida* cases, while otalgia occurred in 48.5% and 56.5%, respectively. Tinnitus and headache were more frequently observed in the *Aspergillus* group (54.5% and 43.2%) compared to the *Candida* group (39.1% and 39.1%, respectively). Vertigo was uncommon in both groups.

None of the clinical manifestations showed a statistically significant difference between *Aspergillus* and *Candida* infections (all p-values >0.05). Despite this, several symptoms were numerically more frequent in the *Candida* group, suggesting a tendency toward more pronounced clinical manifestations, although these differences were not statistically significant (Table III).

Comparison of Physical Examination Findings

The comparison of otoendoscopic findings between fungal groups is presented in Table III. Fungal debris was identified in all cases (100%). The predominant appearance in both groups was whitish debris, observed in 57.6% of *Aspergillus* and 70.0% of *Candida* infections. Brownish debris was the second most common morphology, found in 30.3% of *Aspergillus* and 13.0% of *Candida* cases. Mixed appearances, including whitish debris with brown or black spores, were less frequently observed.

Ear discharge was present in 54.5% of *Aspergillus* and 65.2% of *Candida* infections. Tympanic membrane perforation was observed in 57.6% of *Aspergillus* and 56.5% of *Candida* cases. Erythema and edema of the EAC were identified in a smaller proportion of isolates, and tragus tenderness was uncommon in both groups.

Whitish debris was more frequently observed in *Candida* infections, whereas brownish debris was relatively more common in the Aspergillus group. However, no statistically significant differences were found in any of the physical examination findings between Aspergillus and *Candida* infections (all p-values >0.05) (Table III).

Table I: Profile and frequency of isolated fungi

Isolate	n=56 (%)
Aspergillus	n=33 (58.9%)
Aspergillus flavus	16 (48.5%)
Aspergillus niger	9 (27.3%)
Aspergillus fumigatus	3 (9%)
Aspergillus oryzae	1 (3%)
Aspergillus galucus	1 (3%)
Aspergillus tamarii	1 (3%)
Aspergillus terreus	1 (3%)
Aspergillus candidus	1 (3%)
Candida	n=23 (41.1%)
Candida parapsilosis	9 (39.1%)
Candida kefyr	2 (8.7%)
Candida albicans	1 (4.3%)
Candida utilis	1 (4.3%)
Candida tropicalis	6 (26.1%)
Candida glabrata	1 (4.3%)
Candida krusei	3 (13%)
Mixed Infection	n=18
C. parapsilosis & C. albicans	1
C. parapsilosis & C. tropicalis	2
C. parapsilosis & C. crusei	1
A. flavus & A. fumigatus	1
A. flavus & C. parapsilosis	2
A. flavus & C. glabrata	1
A. niger & C. tropicalis	1

Table II: Age group and gender classification of subjects

Variables	Aspergillus n (%)	Candida n (%)	Total n (%)	p-value
Age				
11-20th	3 (9.1%)	3 (13%)	6 (10.7%)	0.364
21-30th	6 (18.2%)	8 (34.8%)	14 (25%)	
31-40th	9 (27.3%)	7 (30.4%)	16 (28.6%)	
41-50th	3 (9.1%)	3 (13%)	6 (10.7%)	
51-60th	8 (24.2%)	2 (8.7%)	10 (17.9%)	
61-70th	3 (9.1%)	0	3 (5.4%)	
71-80th	1 (3%)	0	1 (1.8%)	
Gender				
Male	18 (54.5%)	9 (39.1%)	27 (48.2%)	0.388
Female	15 (45.5%)	14 (60.9%)	29 (51.8%)	

Comparison of Predisposing Factors

The most frequently reported predisposing factors included a history of ear infection (80.4%), water exposure during bathing (78.6%), ear drop use (76.8%), and ear manipulation with cotton buds (75.0%). Among patients with a history of ear infection, 72.3% were diagnosed with chronic suppurative otitis media. A history of recent swimming (within one month) and prior ear surgery were reported in 16.1% and 14.3% of isolates, respectively. No patients reported hearing aid use.

Comparative analysis demonstrated that ear drop use and cotton bud manipulation were significantly associated with fungal group (p=0.042 and p=0.041, respectively), with both factors more frequently reported in *Aspergillus* isolates compared to *Candida*. In contrast, the distribution of previous ear infection, water exposure, recent swimming, and prior ear surgery did not differ significantly between the two groups (all p-values >0.05) (Table III).

DISCUSSION

This study demonstrated that *Aspergillus spp.* were the predominant causative agents of otomycosis, consistent with previous reports in which *A. flavus* and *A. niger* constituted the majority of isolates.[3] This predominance may be attributed to the ubiquitous environmental presence and saprophytic nature of *Aspergillus*, as well as the favorable microenvironment of the EAC, which provides organic substrates for fungal growth, including keratin debris and glycoprotein- and polysaccharide-containing components of cerumen and epithelial cells.[3,9]

However, studies from other regions, such as Spain, have reported *Candida* as the leading etiological agent, suggesting the influence of geographic variation, environmental conditions, and local practices, including ear hygiene and topical medication use.[2] The presence of mixed infections in this study further supports the polymicrobial nature of otomycosis.[10]

Table III: Clinical manifestations and predisposing factors of otomycosis

Variables	Aspergillus n=33 (%)	Candida n=23 (%)	Total n=56 (%)	p-value
Clinical Manifestation				
Itching				
Yes	26 (78.8%)	20 (87%)	46 (82.1%)	0.5 (>0.05)*
No	7 (21.2%)	3 (13%)	10 (17.9%)	
Hearing loss				
Yes	26 (78.8%)	19 (82,6%)	45 (80.4%)	1 (>0.05)*
No	7 (21.2%)	4 (17.4%)	11 (19.6%)	
Ear Discharge				
Yes	19 (57.6%)	14 (60.9%)	33 (58.9%)	1 (>0.05)
No	14 (42.4%)	9 (39.1%)	23 (41.1%)	
Tinnitus				
Yes	18 (54.5%)	9 (39.1%)	27 (48.2%)	0.388 (>0.05)
No	15 (45.5%)	14 (60.9%)	29 (51.8%)	
Ear fullness				
Yes	23 (69.7%)	18 (78.3%)	41 (73.2%)	0.685 (>0.05)
No	10 (30.3%)	5 (21.7%)	15 (26.8%)	
Otalgia				
Yes	16 (48.5%)	13 (56.5%)	29 (51.8%)	0.749 (>0.05)
No	17 (51.1%)	10 (43.5%)	27 (48.2%)	
Headache				
Yes	14 (42.4%)	9 (39.1%)	23 (41.1%)	1 (>0.05)
No	19 (57.6%)	14 (60.9%)	33 (58.9%)	
Physical Examination				
Fungi identified with otoendoscopic examination				
Yes	33 (100%)	23 (100%)	56 (100%)	-+
No	0	0	0	
Morphology of fungi				
White debris	19 (57.6%)	16 (70%)	35 (62.5%)	0.247 (>0.05)
Brownish debris	10 (30.3%)	3 (13%)	13 (23.2%)	
Black spores	0 (0%)	2 (9%)	2 (3.6%)	
White debris with brown spores	3 (9%)	1 (4%)	4 (7.1%)	
White debris with black spores	1 (3%)	1 (4%)	2 (3.6%)	
Edematous EAC				
Yes	4 (12.1%)	3 (13%)	7 (12.5%)	1 (>0.05)*
No	29 (87.8%)	20 (87%)	49 (87.5%	
Hyperemic EAC				
Yes	7 (21.2%)	4 (17.4%)	11 (19.6%)	1 (>0.05)*
No	26 (78.8%)	19 (82.6%)	45 (80.5%)	
Tragus pain				
Yes	1 (3%)	2 (8.7%)	3 (5.4%)	
No	32 (97%)	21 (91.3%)	53 (94.6%)	0.562 (>0.05)*
Discharge in EAC				
Yes	18 (54.5%)	15 (65.2%)	33 (58.9%)	0.601 (>0.05)
No	15 (45%)	8 (34.8%)	23 (41.1%)	
Tympanic membrane				
Perforated	17 (51.5%)	15 (65.2%)	32 (57.1%)	0.55 (>0.05)
Intact	13 (39.4%)	7 (30.4%)	20 (35.7%)	
Cannot be assed (patient with history of mastoidectomy surgery)	3 (9.1%)	1 (4.3%)	4 (7.1%)	
Predisposing Factors				
History of water exposure during bathing				
Yes	24 (72.7%)	20 (87%)	44 (78.6%)	0.322 (>0,05)*
No	9 (27.3%)	3 (13%)	12 (21.4%)	
History of swimming				
Yes	4 (12.1%)	5 (21.7%)	9 (16.1%)	0.464 (>0.05)*
No	29 (87.9%)	18 (78.3%)	47 (83.9%)	
History of ear drop usage				
Yes	29 (87.9%)	14 (60.9%)	43 (76.8%)	0.042 (<0.05)[a]
No	4 (12.1%)	9 (39.1%)	13 (23.2%)	
History of ear infection				
Yes				
No	26 (78.8%)	19 (82.6%)	45 (80.4%)	1 (>0.05)*
	7 (21.2%)	4 (17.4%)	11 (19.6%)	

Table III: Clinical manifestations and predisposing factors of otomycosis

Variables	Aspergillus n=33 (%)	Candida n=23 (%)	Total n=56 (%)	p-value
History of ear surgery				
Yes	6 (18.2%)	2 (8.7%)	8 (14.3%)	0.449 (>0.05)*
No	27 (81.8%)	21 (91.3%)	48 (85.7%)	
History of ear manipulation with cotton buds				
Yes	21 (63.6%)	21 (91.3%)	42 (75%)	0.041 (<0.05)[a]
No	12 (36.4%)	2 (8.7%)	14 (25%)	
History of hearing aid usage				
Yes	0	0	0	-+
No	33 (100%)	23 (100%)	56	

[a]significance in statistics
*fisher's extract test
+no statistics are computed because constant

Both *Aspergillus* and *Candida* infections were most frequently observed in the 31–40-year age group, followed by the 21–30-year group, corresponding to the working-age population.[11] This pattern suggests that exposure-related factors may play a greater role than species-specific susceptibility. In terms of gender, *Aspergillus* infections were more common in males, whereas *Candida* infections were more frequent in females, although no statistically significant association was identified. These findings indicate that gender is not a reliable distinguishing factor. The observed differences may instead reflect behavioral or environmental influences rather than inherent anatomical differences, such as in health-seeking behavior.[12]

The clinical manifestations were largely similar between the two groups, with itching, hearing loss, and aural fullness as the most common symptoms. Pruritus remains the hallmark feature of otomycosis due to fungal irritation of the EAC.[12] The high frequency of hearing loss and aural fullness may be attributed to the substantial proportion of patients with underlying chronic suppurative otitis media (72.3%), as well as mechanical obstruction from fungal debris.[7] In addition, chronic suppurative otitis media may further promote fungal colonization through epithelial maceration and the availability of nutrients from persistent discharge.[13] Although these symptoms were numerically more frequent in the *Candida* group, suggesting a tendency toward more pronounced presentation, the substantial overlap limits differentiation of fungal etiology based on clinical features alone.

Otoscopic or otoendoscopic examinations remain essential for the initial diagnosis of otomycosis, although classical findings such as a "blotting paper-like" appearance are not consistently observed.[1,14] In this study, whitish debris was predominantly observed in *Candida* infections (70%), consistent with previous descriptions of white or creamy deposits.[1] However, a similar appearance was also observed in a substantial proportion of *Aspergillus* cases (57.6%), possibly reflecting mixed infections or variability in fungal growth stages. Brownish debris was the second most frequent finding in *Aspergillus* infections (30.3%), aligning with the role of spore pigmentation, including melanin production in species such as *A. flavus*, which contributes to a darker colony appearance.[14-15]

Other physical findings, including ear discharge and tympanic membrane perforation, were commonly observed in both groups, likely reflecting the high prevalence of underlying chronic suppurative otitis media in this study. Although previous studies have suggested a higher association of tympanic membrane perforation with *Candida* infections, this distinction was not observed in the present study.[16] These findings indicate substantial overlap in clinical and otoscopic features between fungal species.

Regarding predisposing factors, ear drop use and cotton bud manipulation were significantly more frequent in *Aspergillus* infections. Mechanical trauma from ear manipulation may disrupt the epithelial barrier, while repeated use of ototopic medications can alter the local microenvironment, thereby facilitating fungal colonization.[11,14] Topical agents, particularly antibiotics and corticosteroids, may further disrupt the normal bacterial flora and increase canal pH, creating conditions favorable for fungal growth.[12] This association may reflect ecological selection pressure within the EAC. Other commonly recognized risk factors, including prior ear infection, water exposure, swimming, and previous ear surgery, were highly prevalent but did not differ significantly between fungal groups.[2] Previous studies have reported that otomycosis may involve the middle ear in approximately 10% of cases; however, a substantially higher proportion of middle ear disease was observed in this study (72.3%).

Overall, although differences were observed in fungal distribution and certain associated risk factors, the clinical and otoscopic presentations of otomycosis were largely comparable between *Aspergillus* and *Candida* infections. These findings underscore the importance of microbiological confirmation to ensure accurate diagnosis and appropriate management, particularly in settings with a high burden of chronic ear disease.

Strengths and limitations

This study directly addressed the primary objective by systematically comparing clinical manifestations, physical findings, and predisposing factors between *Aspergillus* and *Candida* otomycosis, an area that remains relatively underexplored in previous literature. The isolate-based analysis allowed for a more detailed evaluation of fungal-

specific patterns, including mixed infections. In addition, the study provides valuable regional data from a tertiary referral center in Central Java, Indonesia, contributing to the epidemiological understanding of otomycosis in a tropical setting.

However, this study also has limitations. The relatively small sample size may have limited the ability to detect statistically significant differences between groups. The cross-sectional design precludes causal inference, and associations between predisposing factors and fungal species should be interpreted cautiously. The isolate-based approach may introduce clustering effects in cases with bilateral or mixed infections, and the use of patient-reported data for predisposing factors carries a risk of recall bias.

CONCLUSION

Aspergillus spp. were the predominant causative agents of otomycosis, followed by *Candida* spp., with a notable proportion of mixed infections. Despite differences in etiological distribution, clinical manifestations and physical examination findings showed substantial overlap between the two groups, with no statistically significant differences. Although certain descriptive trends were observed, these were not sufficient for reliable clinical differentiation. Ear drop use and cotton bud manipulation were significantly associated with Aspergillus infections, while other predisposing factors did not differ between groups. Overall, these findings indicate that clinical assessment alone is insufficient to distinguish between *Aspergillus* and *Candida* otomycosis, and microbiological examination remains essential for accurate diagnosis and appropriate management.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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ETHICAL APPROVAL

This study was approved by the Health Research Ethics Committee of Jenderal Soedirman University (No. 018/KEPK/PE/II/2022). Written informed consent was obtained from all participants prior to data collection.

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