RESEARCH PAPER

Clinico-Micro-Pathological Profile of Fungal Infections of Ear, Nose and Throat in a Tertiary Care Hospital

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ABSTRACT

Introduction: Fungal infections of the ear, nose and throat (ENT) region have emerged as an important cause of morbidity in both immunocompetent and immunocompromised individuals. The clinical spectrum of infections ranges from superficial, localized conditions like otomycosis, oral thrush and allergic fungal rhinosinusitis to aggressive, life-threatening invasive diseases like mucormycosis. Early and accurate diagnosis of ENT fungal infections requires a multidisciplinary approach involving clinical evaluation, proper microbiological identification, and histopathological confirmation.

Materials and methods: A prospective observational study done at department of Pathology in collaboration with the department of Microbiology and Department of Otorhinolaryngology (ENT) in a tertiary care hospital from January 2025 to December 2025. Patients attending the outpatient departments with clinically suspected fungal infections involving ear, nose and throat were chosen as study population. Total 68 patients were selected with clinically suspected oropharyngeal candidiasis, fungal otitis externa and paranasal sinusitis. Oropharyngeal swabs from tongue, palate, oral rinses, mycelial matts/discharges from the external auditory canal, and sinonasal tissue and thick mucus secretions swabs from the nasal cavity were collected and sent for microbiological investigation and histopathological examination.

Results: 68 patients were included in the study. 42 (61.8%) were males and 26 (38.2%) females, showing a male predominance. Nasal infections were commonest followed by ear and throat respectively. Site specific distribution showed that Aspergillus spp. was commonest in both ear and nose infections while Candida albicans was commonest in infections of oropharynx. The distribution of predisposing factors among ear, nose, and throat cases demonstrates varying patterns across the three groups.

Conclusion: It may be concluded that Aspergillus niger and Aspergillus flavus were most common implicated in otomycosis and paranasal sinusitis. HIV positivity and faulty dentures were causative factors in establishing oropharyngeal candidiasis by Candida albicans.

Keywords: Fungal infections of the ear, nose, and throat, Aspergillus, Candida albicans.

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INTRODUCTION

Fungal infections of the ear, nose and throat (ENT) region have emerged as an important cause of morbidity in both immunocompetent and immunocompromised individuals. The clinical spectrum of infections ranges from superficial, localized conditions like otomycosis, oral thrush and allergic fungal rhinosinusitis to aggressive, life-threatening invasive diseases like

mucormycosis**.** Although many fungal infections are superficial and self-limiting, some can become invasive and potentially life-threatening, especially in immunocompromised individuals.[1]

The increasing incidence of ENT fungal infections can be attributed to multiple predisposing factors such as prolonged use of antibiotics and corticosteroids, rising prevalence of uncontrolled diabetes mellitus, immunosuppressive conditions, malignancies, and widespread use of medical devices.[2] Opportunistic fungi such as *Aspergillus* and *Candida* species are among the most commonly implicated organisms, while others like *Mucor* species are associated with rapidly progressive and invasive disease.[3]

The ear, nose and throat provide a favourable environment for fungal growth due to warmth, humid climate, and exposure to environmental spores. Infectious particles in the size range larger than 10μm get deposited on nasal or tracheal epithelium and are readily expelled or phagocytosed. Particles in the range of 5 to 10 μm may gain entry to the lower respiratory tract. *Candida* has an affinity for fibronectin, thus facilitates attachment to cellular surface. It is also seen that *Candida* can gain access to bloodstream through intact gastrointestinal mucosa.[4,5]

Clinically, patients may present with a wide spectrum of symptoms such as ear discharge, itching, nasal obstruction, facial pain, headache, and throat discomfort, often mimicking bacterial infections. This overlap frequently leads to delayed diagnosis and inappropriate treatment.

Early and accurate diagnosis of ENT fungal infections requires a multidisciplinary approach involving clinical evaluation, proper microbiological identification, and histopathological confirmation. While clinical features may raise suspicion, microbiological techniques like direct microscopy and culture help in identifying the causative organism, and histopathology plays a crucial role in differentiating invasive from non-invasive disease. A combined clinico-micro-pathological assessment is therefore essential for timely diagnosis, appropriate management, and prevention of complications.

In a tertiary care hospital setting, where patients with diverse risk factors and comorbidities are managed, understanding the profile of ENT fungal infections becomes particularly important. Despite the growing burden, there is limited comprehensive data integrating clinical, microbiological, and histopathological findings, especially in the Indian context.

Hence, this prospective study aims to evaluate the clinico-micro-pathological profile of fungal infections of the ear, nose and throat in a tertiary care hospital, with an emphasis on identifying common etiological agents, associated risk factors, clinical presentations, and their correlation with laboratory findings. Such insights will aid in improving diagnostic accuracy, guiding effective treatment strategies thereby reducing disease-related morbidity and mortality.

AIM & OBJECTIVES OF THE STUDY

This study was conducted –

- To determine the distribution of fungal infections across ear, nose, and throat.
- To analyze the clinical presentation of fungal infections at different ENT sites.
- To identify the predisposing risk factors associated with ENT fungal infections.
- To isolate and identify the fungal organisms responsible for these infections using microbiological methods.

MATERIALS AND METHODS

Type of study: prospective observational study.

Place of study: Department of Pathology in collaboration with the department of Microbiology and Department of Otorhinolaryngology (ENT) in a tertiary care hospital.

Duration of study: A period of 12 months from January 2025 to December 2025.

Study Population: patients attending the outpatient departments with clinically suspected fungal infections involving ear, nose and throat.

Inclusion criteria : patients presenting to OPD with complaints of burning pain or soreness in mouth with curdy white patches, pain and fullness in ears, headache and progressive nasal obstruction, loss of smell with viscid mucus secretion.

Exclusion criteria: patients on topical or oral antifungal therapy at the time of presentation, patients at extremes of age (< 5 years and > 70 years of age) and pregnant women at the time of presentation.

Patient consent: Written and informed consent was taken from every patient.

Sample size: 68 patients were selected from the OPDs with clinically suspected oropharyngeal candidiasis, fungal otitis externa and paranasal sinusitis.

Sample collection: For oropharyngeal candidiasis, proper history (e.g. HIV status) was taken and swabs from tongue, palate, oral rinses were collected. In cases of fungal otitis externa, history of diabetes mellitus and other personal habits were asked followed by collection of fungal debris by dry mopping/syringing and the swabs were sent for microscopy and culture. For suspected fungal sinusitis, clinical examination and radiographic confirmation was done and thick viscid mucus secretions from the nasal cavity (by swabbing) and sinonasal tissue were collected. Deep tissue samples were collected in two sterile containers, one sent for microbiological investigation in sterile normal saline and another for histopathological examination in formalin.

Sample Processing:

Microbiological Analysis: Clinical samples were processed by microscopy (Gram staining for budding yeast cells with pseudohyphae and 20% KOH mount for showing hyaline, septate/ broad aseptate branching fungal hyphae) for presumptive identification. Fungal culture was done on paired Sabourad's Dextrose Agar (SDA) slants and incubated at 25°C and 37°C respectively upto 3weeks. *Candida spp*. were identified by white, pasty, dull colonies and Gram staining showing oval budding yeast cells. *Candida albicans* was confirmed by positive Germ-tube test and terminal single Chlamydospore formation on Cornmeal agar (CMA) by Dalmau plating technique. For moulds (and*)*, identification was based on gross colony morphology (moderately rapid growth with fluffy, velvetty colonies having powdery granular texture on obverse and pale to tan reverse side for *Aspergillus spp.* and loose, woolly, rapid-growths filling entire SDA tubes for *Mucorales*). Brief microscopic morphology was appreciated by teased-mount preparation from the filamentous colony growth. For species identification, slide culture was done on glass petri-plates followed by Lactophenol Cotton Blue (LPCB) mount preparation.

Histopathological Analysis: In histopathological study, tissue sections were subjected to Haematoxylin-Eosin (H&E) stain, Periodic-Acid-Schiff stain (PAS) and Grocott-Gomori's Methenamine Silver stain (GMS) to confirm presence of fungal elements in tissues.

All demographic variables were recorded for patients, details were entered in Microsoft Excel Sheet and data analysis was done by SPSS-software.

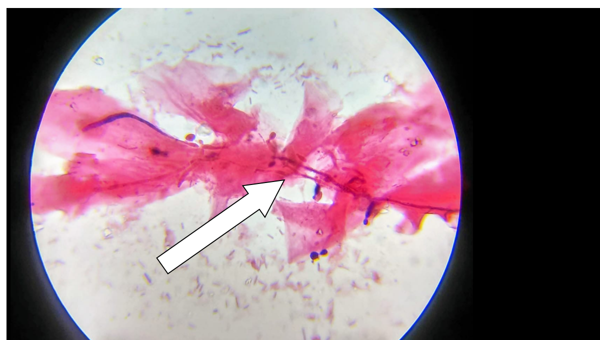


Fig 1: Gram staining from samples: Budding yeast cells with pseudohyphae (Oropharyngeal Candidiasis)

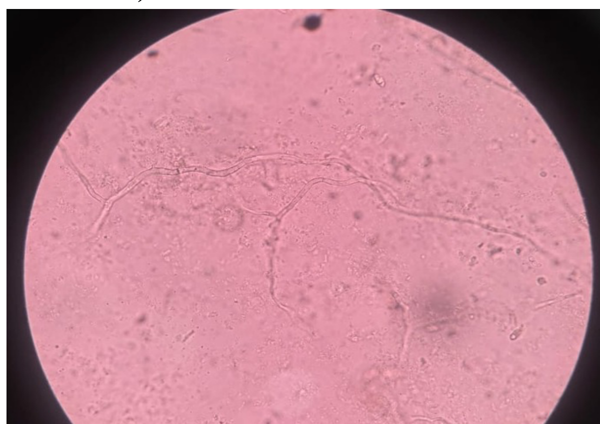


Fig 2: KOH Mount of samples showing hyaline, septate hyphae with acute-angled branching s/o *Aspergillus spp.*

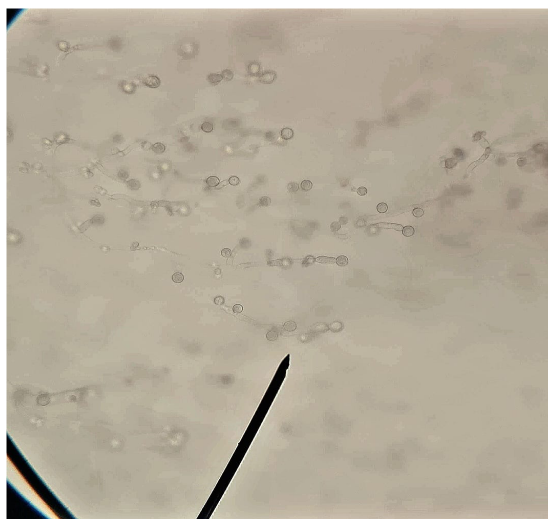
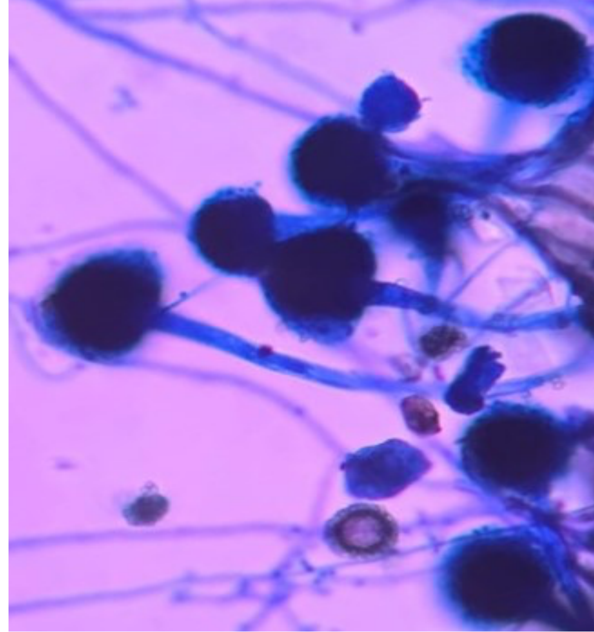
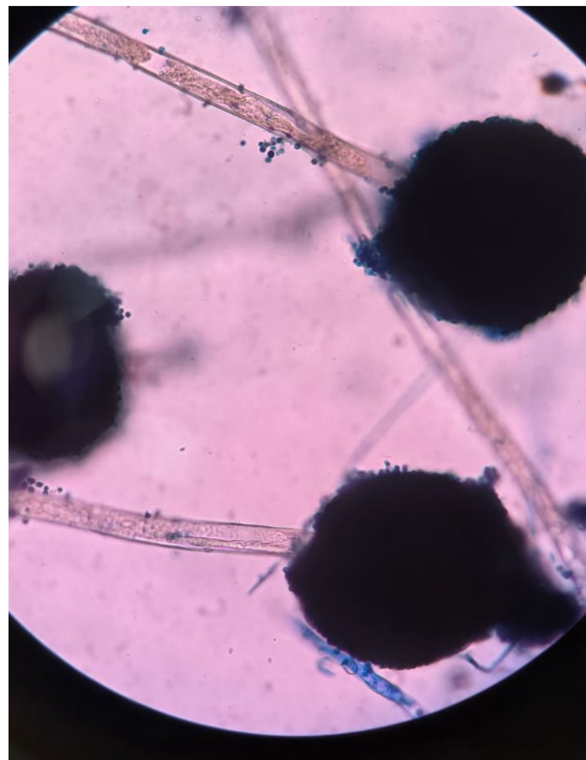


Fig 3: Terminal Single Chlamydospore on Cornmeal agar by Dalmau plating : (*Candida albicans*)

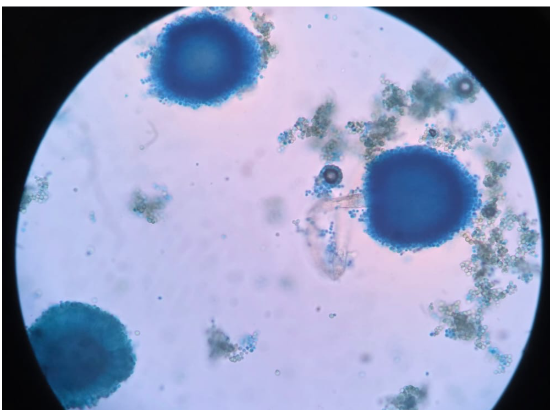


LPCB Mount: ***Aspergillus fumigtes*** **(40X)**

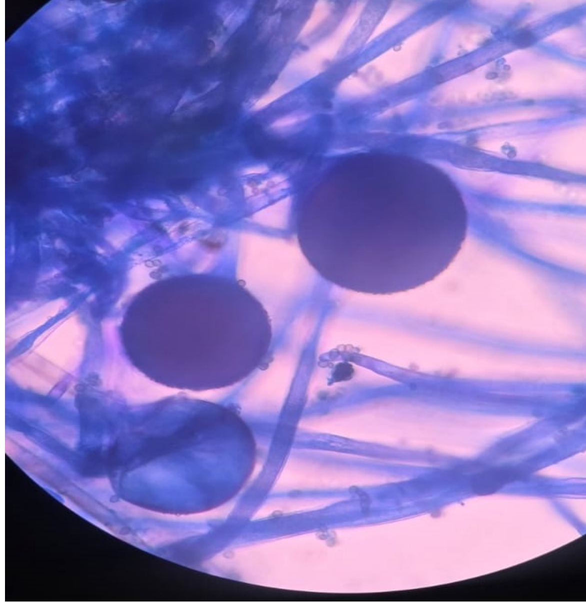
Fig 4: Gross colony morphology of *A. flavus, A.fumigatus & A. niger* on SDA



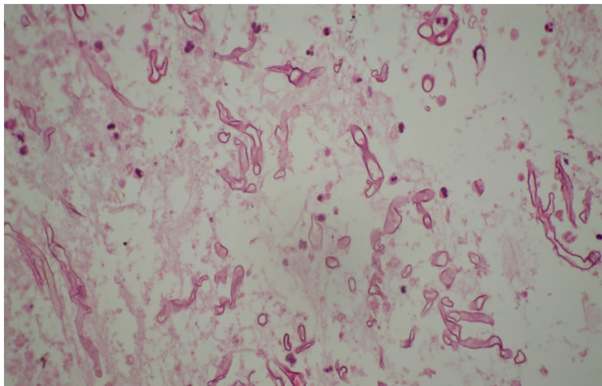
LPCB Mount: ***Aspergillus niger*** **(40X)**



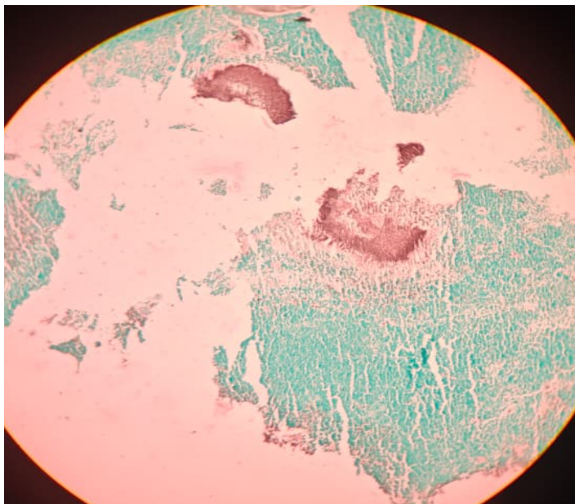
LPCB Mount: ***Aspergillus flavus*** **(40X)**



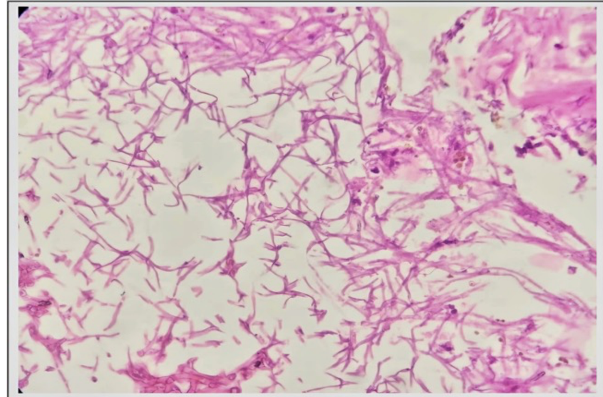
Broad, aseptate, ribbon hyphae, sporangiophores and sporangia: Mucorales (40X)



H&E stain(40X): Braod, aseptate, ribbon-like hyphae consistent with Mucorales



(10X) Grocott's Methenamine Silver staining showing presence of fungal elements in tissue section.



40X H&E: slender ,septate dichotomous acute angled branching of fungal hyphae consistent with aspergillus

RESULTS:

A total of 68 patients with suspected ENT fungal infections were included in the study. Among them, 42 (61.8%) were males and 26 (38.2%) were females, showing a male predominance. Site-wise distribution revealed that nasal infections were most common (32/68; 47.1%), followed by ear infections (25/68; 36.8%) and throat infections (11/68; 16.2%). Among 25 ear infection (Otomycosis) cases, the most common presenting symptoms were intense itching with pain in 18 cases (72%) and sense of ear-fullness and fungal debris on otoscopy in 12 cases (72%) followed by decreased hearing in 5 cases (20%) and pinna lesions in 3(12%). Among 32 nasal infection cases, the predominant complaints were progressive nasal obstruction [26(81%)] and headache [26(81%)] followed by sinus tenderness [19 (59.3%)] and viscid mucous discharge [10(31.25%)]. Among 11 throat infection cases, the common clinical presentations were curdy white plaques and burning soreness of mouth both [09(81.81%)] followed by red lesions on tongue [6 (54.54%)]

Among ear infections (n=25), the most common predisposing factor was use of unsterile objects for ear cleaning, observed in 12 cases (48.0%), followed by use of unsterile ear oil (20.0%). Other factors included habitual swimming and topical eardrop usage (12.0% for each) and diabetes mellitus (8%). Among nasal infections (n=32), allergy/atopy (34.4%) was the most common predisposing factor, followed by smoking (28.1%) and uncontrolled diabetes mellitus (21.9%). Post-surgical status like Septoplasty for deviated nasal septum (9.4%) and inhaled steroid use for

asthma/COPD (6.25%) were less frequent predisposing factors. Among throat infections(n=11), HIV/AIDS (45.5%) was the predominant underlying risk factor for oropharyngeal candidiasis, followed by faulty dental prosthesis with poor oral hygiene(18.2%), smoking (18.2%) and anticancer therapy (9%). Overall, the findings suggest that presence of comorbid conditions, lifestyle habits, medication misuse, history of atopy/allergy and immunosuppression are key contributors to acquire fungal infections in ear-nose-and-throat, with distinct leading factors in each category of infections.

After routine microbiological processing, histopathological examination revealed that *Aspergillus species* were the predominant fungi isolated from specimens of the external auditory canal and nose and paranasal sinuses, with *A. niger* and *A. flavus* being the most frequent species. In contrast, fungal infections of throat were mainly associated with *Candida albicans*, which emerged as the principal pathogen in this region. In addition to the commonly encountered fungi, less-common etiological agents like cases of mucormycosis by *Rhizopus spp*. were also identified by both microbiological and histopathological evaluation. Recognition of these findings further emphasized the importance of histopathological examination in confirming diagnosis and guiding appropriate therapeutic management of ENT fungal infections.

Table 1: Predisposing Factors for Fungal Infections in Ear, Nose and Throat

Factors	**Ear**		**Factors**	**Nose**		**Factors**	**Throat**	
	No of patients (25)	**%**		**No of patients (32)**	**%**		**No of patients (11)**	**%**
Unsterile stick use for cleaning ears	12	**48%**	Inhaled steroid for asthma/COPD	2	**6.25%**	Faulty dental prosthesis with poor oral hygiene	2	**18.2%**
Unsterile ear-oil use	5	**20%**	Uncontrolled DM	7	**28%**	Inhaled steroids	1	**9%**
Habitual Swimming	3	**12%**	Allergy/atopy	11	**34.3%**	HIV/AIDS	5	**45.5%**
Topical eardrops use	3	**12%**	Smoking	09	**28.2%**	Smoking	2	**18.2%**
Diabetes Mellitus	2	**8%**	Post-Septoplasty	3	**9.4%**	Anticancer therapy	1	**9%**

Fungal culture analysis of 68 cases revealed distinct organism distribution across different anatomical sites. Among ear infections (otomycosis), *Aspergillus niger* was the predominant isolate, identified in 19 cases (76.0%), followed by *Aspergillus flavus* in 5 cases (20.0%). *Candida albicans* was isolated from only 1 case (4.0%). In nasal infections, *Aspergillus flavus* was the most common organism (46.88%), followed by *Aspergillus fumigatus* (37.5%). Notably, Mucorales group of fungi (*Rhizopus spp*.) were isolated in 9.37% cases, indicating the threat of potentially invasive fungal infections. Among throat infections (oropharyngeal candidiasis), all cases (100%) were caused by *Candida albicans*.

Table 2: Distribution of fungi in Ear, Nose and Throat infections (n = 68)

	Isolated Organism	No. of Patients	%
Ear	*Aspergillus niger*	19	76%
	Aspergillus flavus	05	20%
	Candida albicans	01	04%
	Total No. of cases	**25**	**100%**
Nose	*Aspergillus flavus*	15	46.88%
	Aspergillus niger	02	6.25%
	Aspergillus fumigatus	12	37.5%
	Rhizopus spp.	03	9.37%
	Total No. of cases	**32**	**100%**
Throat	*Candida albicans*	**11**	**100%**

Table3: Symptom-wise presentation of fungal infections in Ear-Nose-and-Throat

Site	Clinical findings	No of Cases	Percentage of presentations
EAR (Total 25 cases)	**Intense itching and pain**	**18**	**72%**
	Fullness of ears with Debris on otoscopy	**18**	**72%**
	Decreased hearing	**5**	**20%**
	Lesions on pinna	**3**	**12%**
NOSE & PNS (Total 32 cases)	**Progressive nasal obstruction**	**26**	**81%**
	Headache	**26**	**81%**
	Sinus tenderness	**19**	**59.3%**
	Viscid Mucous discharge	**10**	**31.25%**
THROAT (Total 11 cases)	**Curdy white plaques**	**09**	**81.81%**
	Red lesions on tongue	**06**	**54.54%**
	Burning/soreness mouth	**09**	**81.81%**

DISCUSSION

Fungal infections of the ear, nose, and throat (ENT) are increasingly recognized in clinical practice due to changing environmental conditions, widespread use of antibiotics and steroids, and a rising population of immunocompromised individuals. The present prospective study provides a comprehensive clinico-microbiological-pathological profile of ENT fungal infections in a tertiary care hospital setting.

In the current study, a **male predominance (61.8%)** was observed, which is consistent with several previous studies. This may be attributed to increased outdoor exposure, occupational factors, and a greater likelihood of environmental contact with fungal spores among males.

Site-wise distribution revealed that **nose and paranasal sinus infections (47.1%) were the most common**, followed by ear (36.8%) and throat infections (16.2%). This finding contrasts with many earlier reports where otomycosis predominated, but aligns with recent trends **showing an increase in fungal rhinosinusitis**, possibly due to rising allergic conditions, uncontrolled diabetes, and inhaled steroid usage. The higher incidence of nasal involvement in this study also reflects improved diagnostic awareness and increased use of endoscopic evaluation. The clinical presentation varied according to the site of infection.

Among ear infections, **72% patients experienced intense itching with pain and fullness of ears with debris. Decreased hearing was seen in 20% cases.** These findings are in agreement with classical descriptions of otomycosis, where itching is considered the hallmark symptom due to fungal colonization and irritation of the external auditory canal.

In nasal infections, **both progressive nasal obstruction and headache were the predominant symptoms in 81% patients. Sinus tenderness (59%)** and **viscid mucous discharge (31%) were also significant findings** that warrant prompt diagnosis and aggressive management, as they may be associated with rapid spreading invasive fungal sinusitis by Mucorales group of fungi.

Among throat infections, **81.81% patients presented with white curdy plaques and burning soreness of mouth**, consistent with oropharyngeal candidiasis. This correlates well with the presence of

immunocompromised states like HIV infection observed in the study population.

All clinical and micro-pathological study of fungal infection of ear, nose and throat revealed that the common predisposing factors for otomycosis were injury to canal wall caused by **introducing unsterile sticks in 48%, use of unsterile oil in 20%, habitual swimming & topical eardrops instillation (12% each), followed by Diabetes mellitus in 8%.**[6] Most common predisposing factors in nose & PNS infections were **allergy in 34.3%, smoking in 28.2%, uncontrolled DM in 28%, post-septoplasty in 9.4%** and prolonged uses of inhaled steroids in 6.25%. Predisposing factors for oropharyngeal candidiasis were **HIV/AIDS (45.5%), followed by faulty dental prosthesis with poor oral hygiene (18.2%) and smoking (18.2%)** Anticancer therapy(9**%) and steroid use (9%).**[7]

In ear infection, isolated mycosis were present, *Aspergillus niger 76%, Aspergillus flavus* 20% and *Candida albicans* 4%. Isolated mycosis in nose infections were present *Aspergillus flavus* 46.88%, *Aspergillus fumigatus* 37.5%, *Rhizopus spp.* in 9.3% and *Aspergillus niger* 6.25%. 100 percent of all the patients of throat infection patients were affected from *Candia albicans*.[8]

K O Paulose et al (1989) conducted a prospective study at the Bahrain Military Hospital for a period of one year, after detailed history and examination, a clinical diagnosis of otomycosis was made. A sterile cotton wool application swab was taken and sent for analysis for bacterial and fungal growth. Results revealed that out of 193 patients, 171 cases produced positive fungal isolates and *Aspergillus species (niger and fumigatus)* have been the most common fungal pathogens which is similar to our study.[9]

Mohanty J C et al (1999) carried out a study in 54 patients attending ENT OPD in Berhampur. After establishing a clinical diagnosis of otomycosis, the commonest fungal isolates were *Aspergillus niger* and other species of *Aspergillus*, which is a similar type of finding of our study.[10]

CONCLUSION

This prospective study highlights that fungal infections of the ear, nose, and throat are a significant clinical entity in tertiary care settings, with a clear variation in presentation, risk factors, and microbial profile across different anatomical sites. A male predominance was observed, and nasal infections emerged as the most common, followed by ear and throat involvement.

The clinical features were largely site-specific, with itching, pain, fullness and decreased hearing in ear infections, progressive nasal obstruction, headache, sinus tendernsess and viscid mucous discharge in sinonasal disease. White plaques burning soreness of mouth and red lesions on tongue in throat infections. The isolation of *Rhizopus spp*. in a subset of cases underscores the potential for rapidly spreading invasive fungal sinusitis, necessitating early recognition and prompt management with debridement and aggressive antifungal therapy.

Microbiologically, *Aspergillus species* predominated in both ear and nasal infections, while *Candida albicans* was exclusively associated with throat infections, reflecting the influence of local environmental and host factors. The study also emphasizes the role of modifiable risk factors, such as unsterile ear practices, allergy, smoking, uncontrolled diabetes, and immunocompromised states, in the development of these infections.

In conclusion, early diagnosis through combined clinical, microbiological and histopathological evaluation, alongwith identification and correction of underlying risk factors, is crucial for effective management and prevention of complications. A multidisciplinary approach and increased awareness can significantly improve patient outcomes in ENT fungal infections.

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