# Mycology of Chronic Suppurative Otitis Media at Tertiary Care Centre of Nepal

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## Abstract

**Objective:** This study was designed to find out the fungal aetiological agents in chronic suppurative otitis media (CSOM) patients attending tertiary care centre of Nepal.

**Result:** Total 123 samples of 117 patients, outdoor as well as indoor from Department of ENT and Head and Neck Surgery (HNS) TUTH, Maharajgunj, Kathmandu those specimens were processed and among them, 23(18.7%) was found potassium hydroxide (KOH) mount positive whereas positive growth was in 27 specimens. The prevalence rate of fungus was 21.95 percent in which the main pathogen was *Aspergillus* species (51.8%), followed by *Candida* species (14.8 %).

**Keywords:** CSOM, KOH, Fungal culture, *Aspergillus*

## Introduction

Chronic suppurative otitis media (CSOM) is characterized by the perforated or non-intact tympanic membrane caused by bacteria, fungi, and fungi as chronic or intermittent infected discharge lasting more than three months. The virus causes mucosal lining inflammation, which often leads to partial or complete loss of the tympanic membrane and ossicles. It is characterized by chronic drainage from the middle ear associated with tympanic membrane (TM) perforation (1-3). There are an estimated 31 million new cases of CSOM worldwide each year, with approximately one-quarter occurring in children <5 years of age (4). CSOM is rare in resource-rich areas, with a prevalence of <1 percent in the United States, 3.5 percent in Nepal, and >4 percent in India (1, 4, 5). It occurs more frequently in resource-limited settings, with prevalence ranging from 6 to 46 percent depending on the geographic area and population studied (6-8). Lack of public awareness about CSOM and delays in seeking care are also likely important contributors (9-11). Some studies have reported that males are more likely to

develop the cholesteatomatous form of CSOM and are more likely to have the persistent disease (12, 13). The reported frequency of bilateral disease ranges from 27 to 55 percent (6, 9). A combination of common risk factors for acute otitis media (AOM) as well as factors associated with low socioeconomic status and insufficient health care are additional risk factors for CSOM. These include: living in crowded conditions, living in a large family, day-care attendance, low parental education level, poor nutrition, and human unhygienic habits such as swimming in polluted ponds and rivers, unsterile ear piercing, and cotton bud cleaning ears (9, 11). In spite of appropriate topical and systemic antibiotics, some cases of a safe form of chronic suppurative otitis media keep discharging. Sen Gupta *et al.* proposed that this intractable otorrhea occurs due to superimposed fungal infections over chronic otitis media (14). Otomycosis is sporadic and is caused by a wide variety of fungi, most of which are saprobes that are found in various types of environmental materials. In chronic suppurative otitis media, the most common fungi found are *Aspergillus* and *Candida*. The warm and moist environment of the ear favours their growth (15). In recent years, as a result of an increase in immunocompromised patients, the frequency of fungal ear infections has increased. Otomycosis is more vulnerable to an immunocompromised host. There is also an elevated risk of possible complications from otomycosis in patients with diabetes, lymphoma, transplantation patients, patients undergoing chemotherapy or radiation therapy, and AIDS patients (16). There is a lack of appropriate evidence on the exact incidence of chronic suppurative otitis media infection superimposed with fungal infection. Therefore, this study was conducted to determine the incidence of fungal infection and the pattern of fungi noted among the patients with chronic suppurative otitis media who attended the ENT and Head and Neck Surgery of TUTH.

## Main Text

### Methods

The laboratory-based study was performed at the Department of Clinical Microbiology. Specimen collection was done in the ENT and Head and Neck Surgery Department of Tribhuvan University Teaching Hospital (TUTH), a tertiary care centre of Nepal from February 2016 to July 2016 (over a period of 6 months). All clinical samples collected from hospitalized as well as outdoor patients having CSOM. Specimens were processed according to standard methodology (according to guidelines of Clinical Microbiology Procedures Handbook-Lynne S. Garcia-Volume 2, Textbook of Medical Mycology- Third Edition-Jagdish Chander and Description of Medical Fungi-Second Edition-David Ellis). A total of 117 patients having CSOM confirmed cases by the otolaryngologists and their 123 specimens were included in the study. Ear discharge was collected using sterile swab sticks which were labelled and sent to the laboratory for KOH Mount and fungal culture studies. Direct smear examination: A small amount of ear discharge was spread of a glass slide and emulsified the specimen in a drop of 20% KOH with the help of an inoculating loop. The smear was then covered with the coverslip and left for 5-10 minutes. Just after the specimen clearing, the preparation was examined microscopically focusing the 10X and finally, observation using 40X objectives with the condenser iris diaphragm closed sufficiently to give a good contrast. Keeping in mind using too intense a light source the contrast would not be adequate and the unstained fungi would not be seen and therefore the preparation was examined carefully for demonstration of shining fungal elements. The smear was examined for relation of host and infectious agents (fungi) involvement i.e. checking the presence of epithelial cells, pus cells, and fungal elements (yeast cells, pseudohyphae, hyphae, spores, etc). Fungal cultivation: Aural swab having ear discharge was inoculated into a Sabouraud dextrose agar (SDA), with chloramphenicol but without cycloheximide (actidione) aseptically. It was kept at 25°C for 2-4 weeks. The isolate was identified on the basis of colony morphology, lactophenol cotton blue (LPCB) preparation, use of CHROMagar, and biochemical tests.

### Result

During the study period (February 2016 to July 2016), a total of 117 infected patients were involved for needful treatment attending as an outpatient department (OPD) and inpatient at TUTH. The aural discharge swabs samples were collected from unilateral as well as bilateral for isolation and identification of the causative agents of infection. A total of 123 specimens were collected and processed.

Distribution of patients according to site

Among the total patients (n=117), 69 (59.0%) were specimens from left ear, 42 (35.9%) right ear and 6 (5.1%) both ear (bilateral). (Table 1.0)

Distribution of potassium hydroxide (KOH) mount results

Out of 123 specimens, 23(18.7%) was found KOH mount positive. (Figure 2.0)

Distribution of fungal isolates

Among total isolates *Aspergillus flavus* 7 (25.9%), *Aspergillus fumigatus* 6 (22.2%), *Acremonium* spp. 3 (11.2%), *Candida albicans* 2 (7.4%), *Penicillium* spp. 2 (7.4%) *Aspergillus niger* 1 (3.7%), *Candida krusei* 1 (3.7%), *Candida tropicalis* 1 (3.7%), *Curvularia* spp. 1 (3.7%), *Fusarium* spp. 1 (3.7%), *Mucor* spp.1 (3.7%) and *Syncephalastrum racemosum* 1 (3.7%). (Table 3.0)

**Discussion**

High-prevalence of CSOM in children may be attributed to the fact that they are more prone to upper respiratory tract infections (URTIs). Furthermore, cold weather pre-disposes children to URT (17, 18). Poor hygiene and unorthodox treatment methods, such as the use of unusual ear drops and concoctions in the middle ear, such as oil and honey, may initiate the proliferation of opportunistic pathogens that obstruct the eustachian tube (ET) (19). Otomycosis is the fungal infection of the ear which includes the external ear, middle ear, and open mastoid cavity (20). Otomycosis is rarely life-threatening but it may be a challenging and frustrating situation for the patient and the otolaryngologist because of long-term treatment and high rate of recurrence (21). Mycological analysis of 123 specimens revealed that 27 (21.95 %) were of fungal origin and the growth rate was noted in the middle of studies by Sen Gupta *et al.* (14) (25%) and Baruah *et al.* (22) (17.48%). This observation was not parallel with the study Kumar H *et al.* (23) (15%) and in contrast with another researcher, Loy *et al.* (8.8%) (24). Analysis of the total 123 samples revealed that mono-microbial growth was obtained in 27 (21.95 %) samples, whereas,96 (77.05%) samples showed no growth. Corresponding figures reported by another researcher vary significantly. Aslam, *et al.* from Pakistan in their study on 142 samples revealed only 2.1% fungi (25). The disparity in the outcomes of different authors may have been due to the difference in the studied patient population and geographical variations. Middle-ear fungal infections are prevalent because fungi in moist pus grow well. The most commonly found fungi in CSOM are *Candida* species and *Aspergillus* species (26). In the present study, fungal aetiology was found in 27 (21.95%) cases out of which 51.85% were *Aspergillus* species (*Aspergillus flavus*-7, *Aspergillus fumigatus* -6, *Aspergillus niger*-1), *Candida* species 14.82% (*Candida albicans*-2, *Candida krusei*-1, *Candida tropicalis*-1) and other saprophytic fungi 33.33% (*Acremonium* spp. -3, *Penicillium* spp. -2, *Curvularia* spp. -1, *Fusarium* spp. -1, *Mucor* spp. -1 and *Syncephalastrum racemosum* -1). Principal fungal isolates were similar to our study in a study from Singapore on 90 patients of otitis media, fungi accounted for 8.8% of the total isolates out of which *Aspergillus* species was principally followed by *Candida* species(24) and similarly in a study from Nigeria on 569 patients of otitis media, fungi isolated were *Aspergillus niger* (9.2%) followed by *Candida albicans* (5.4%)(27), whereas different in a study from Haryana, India fungal aetiology was found in 15% of cases, out of which 60% were *Candida* species and 40% were *Aspergillus* species (23). These findings may be attributed to the environmental effects on the cases of otitis media, which were studied in this area. The postulation of Kunelskyavavya *et al.* indicates that the repeated use of broad-spectrum topical antibiotics contributes to bacterial flora suppression and the eventual appearance of opportunistic fungal flora in the oral cavity and gastrointestinal tract. Likewise, in the middle ear, fungal infection supervenes due to prolonged use of topical antibiotics (28). The immunocompromised host is one of the predisposing factors of fungal infection and the following are situations like diabetes, steroid administration, HIV infection, chemotherapy, and malignancy. Normal bacterial flora is one of the hosts- defence mechanisms against fungal infections (29, 30). In patients using antibiotic ear drops, this process is altered and induces otomycosis. The complications include hearing loss and invasive temporal bone infection. Otomycosis treatment does not complete in a single step but needs complex procedures like microscopic suction clearance of fungal mass, discontinuation of topical antibiotics, and treatment with antifungal ear drops for three weeks. The ear should be kept dry in this period (for three weeks) (31). Diagnosis and management of CSOM due to fungal infections can be really challenging in immunocompromised patients not only more common recurrences as compared to immunocompetent patients but also eradication of the disease may be difficult, who have undergone canal wall down mastoidectomy for attico antral ear disease. For patients facing such conditions prolonged antifungal therapy is required (32).

## Limitations

The research was limited only patients having CSOM.
Genotyping was not done for the isolates.
Antifungal sensitivity was not performed.

## Declarations

**Supplementary information**

Additional file 1: Table 1. Distribution of patients according to site. Table 2. Distribution of KOH mount results. Table 3 Distribution of fungal isolates.

**Abbreviations**

AOM: Acute Otitis Media
CSOM: Chronic Suppurative Otitis Media
DALYs: Disability Adjusted Life Years
e.g.: Exempli Gratia (For Example)
ENT: Ear, Nose, Throat
*et al*: Et Alia (and others)
Fig.: Figure
HNS: Head and Neck Surgery
Hrs.: Hours
IOM: Institute of Medicine
KOH: Potassium Hydroxide
LPCB: Lactophenol Cotton Blue
No.: Number
OPD: Out Patient Department
SDA: Sabouraud Dextrose Agar
SPSS: Statistical Package for Social Science
TUTH: Tribhuvan University Teaching Hospital
URTIs: Upper Respiratory Tract Infections
WHO: World Health Organization

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**Authors' contributions**

Ajay Kumar Chaurasiya: Conceptualization, investigations, statistical analysis, writing an original draft and final version of the manuscript; Dipendra Kumar Mandal, Manoj Mahato: Conceptualization, investigations, writing-review, and editing; Rabindra Bhakta Pradhananga, Niranjan Prasad Sah , Basista Prasad Rijal and Bharat Mani Pokhrel: Conceptualization, investigations, supervision, writing-review, and editing. All authors read and approved the final manuscript.

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**Availability of data and materials**

All data generated or analysed during this study are included in additional information files (Additional file 1: Table 1–3).

**Ethics approval and consent to participate**

The ethical approval for the study was obtained from the Institutional Review Board of the Institute of Medicine, Kathmandu, Nepal (Ref. No. 172). Written informed consent was obtained from each patient before enrolment and where participants are children (under 16 years old) from their parent or guardian.

**Consent for publication**

Not applicable

**Competing Interests**

There are no conflicts of interest.

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