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# A REVIEW ON OTOMYCOSIS: A FUNGAL MENACE IN THE EAR

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***Abstract :*** Otomycosis is a superficial fungal infection that primarily affects the outer auditory ear canal and tympanic membrane. It is mostly prevalent in the regions of tropical and subtropical areas, where high humidity and temperature facilitate the fungal spores. To start colonization, the disease is dominantly caused by the species of Aspergillus. Niger, Aspergillus .flavus, and Candida species. These pathogens will thrive in the moist environment created by predisposing factors such as habitual ear manipulation, swimming, and prolonged use of topical antibiotics or corticosteroids. Systemic diseases, such as diabetes mellitus and immunosuppression, can further lead to an increase in host susceptibility. Patient presented with pruritus, otalgia, aural fullness, and hearing loss. Diagnosis from simple clinical observation to robust strategy, combining otoscopy with laboratory confirmation via potassium hydroxide mounts and fungal cultures, which serves as a golden standard for organism isolation. Modern molecular advancements, including PCR, can make it easier to identify microbiological infections. Management emphasizes a meticulous aural Toilet, combined with antifungal agents, most commonly as old derivatives compounds like clotrimazole and miconazole. Despite effective treatments, higher occurrence rates, and the presence of fungal biofilms pose ongoing challenges. Establishing standardized evidence-based therapeutic protocols and addressing the host-related factors are vital for preventing relapse and improving long-term patient outcomes**.**

***IndexTerms*** **- Otomycosis, External auditory canal, Aspergillus, Candida, Clotrimazole**

## Introduction

Otomycosis is a superficial fungal infection that exclusively affects the external auditory canal and eardrum; it is a clinically significant subset of otitis externa. A wide range of prevalences has been reported in tropical and subtropical regions across the world. The condition is characterized clinically by an intense pruritus, otalgia, and aural fullness. Otorrhea, tinnitus, and hearing loss contribute altogether to considerable patient discomfort and reduced quality of life. The research consistently indicates that otomycosis accounts for a substantial proportion of external ear infections, although the reported prevalence can vary due to differences in the geographical locations, climatic conditions, study populations, and diagnostic methods. The most common or the most predominant methodological species are Aspergillus Niger, Aspergillus. fumigatous and Aspergillus. Flavius, being the most frequently isolated pathogen of a Candida species. Molecular and culture independence studies have further expanded the theological spectrum by noticing the non-dermatophyte moles and mixed fungal, bacterial infections, suggesting that there is a more predominant microbial diversity than previously recognized. Several predisposing factors have been frequently documented during the warm and humid environments, including habitual ear manipulation or instrumentation, prolonged use of topical antibiotics or corticosteroids, swimming, and accumulation of cerumen. Are the root causes of dermatological conditions of the external auditory canal and systemic illnesses such as diabetes mellitus and immunosuppression? A diagnostic strategy has been described in a wide range of clinical settings based on otoscopic findings to laboratory confirmation using the potassium hydroxide mounts, fungal culture, and advanced molecular identification techniques, which will enhance the detection, characterization, and understanding of the pathological and structural features of the pathogen. The management remains challenging with the condition of otomycosis. Emphasizing the meticulous aural toilet, combined with topical antifungal therapy. The most commonly used agents are all derivatives, such as clotrimazole and Miconazole. The recurrence, treatment failure, and concerns regarding the ototoxicity have potential for certain topical agents. Highlighting the absence of standardized, diagnostic, & therapeutic protocols that are limited to the use of antifungal susceptibility testing, and the vital role of addressing the host-related and environmental factors to prevent relapse. (1)

## 1. Systematic reviews and evidence synthesis from 2023 to the present:

Recent literature is dominated by systematic reviews and analysis techniques of global data on prevalence, the etiological agents, risk factors, treatment outcomes, and therapeutic measurements. These studies will mainly outline the large heterogeneity in diagnostic rites and therapeutic protocols across various geographical locations. The current systematic reviews will describe the lack of unlimited standardized management guidelines and fungal accessibility testing, and control trials with insufficient randomization. Fungal, biofilm, information, anti-microbial resistance, host-microbe interaction are the emerging research themes, and there is a dire need for a multidisciplinary evidence-based approach to improve the long-term outcomes of the otomycosis condition. (1)

## 2. Era molecular microbiome 2019 to 2022

A new start of micro molecular diagnostic technique, including the PCR based identification and sequencing patterns, were expanse for recognizing the fungal species spectrum such as as per jealous, and Candida species. Several studies have revealed that mixed

fungal and bacterial infection and greater microbial diversity within the external auditory canal. At this period mark a paradigm shift took place from culture-dependent diagnosis to molecular characterization, influencing both clinical and research to understand the condition. (5)

### 3. From 2010 to 2018, risk factor stratification and refinement of diagnosis

During this period, there is highly focused host-related risk factors such as diabetes mellitus, immunosuppression, dermatological conditions, such as psoriasis, eczema, etc., and chronic otitis media. The diagnostic approaches have become most standardized, and they have been combined with the otoscopic findings with potassium hydroxide mounts and fungal cultures. Review article emphasizing the importance of mycological confirmation and differentiation of otomycosis from other external otitis conditions. (4)

**4. Epidemiological expansion 1980s to the 1990s,** the researchers are mainly focused on expanding the ideological studies and evaluation of prevalence, geographical distribution, and environmental influences for the condition of otomycosis. The studies have been conducted mainly in tropical and subtropical regions where a higher rate of otomycosis incidence was observed, which was linked with climatic factors such as humidity and temperature. Thus, the predisposing factors include air manipulation, swimming, and topical antibiotic use, which are increasingly recognized. At this period, they observed the emergence of retrospective hospital studies and regional prevalence reports.(3)

### 5.The 1950s to 1970s: mycological identification phase

With advancing medical, mycological research was taking a direction towards identifying a positive fungal organism. Cultures are based on the studies during this period, with the Aspergillus species as a predominant pathogen, which was followed by the Candida species. This period makes a first systematic differentiation between a fungal and bacterial otitis, external, and lays the foundation for microbiological confirmation of otomycosis.(2)

### 6. Timeline sequential development of otomycosis:

The earliest literature on otomycosis, often descriptive case reports, documents a fungal growth within the external auditory canal during this period of early descriptive era of clinical recognition in the 1950s. Otomycosis was recognized as a distinct clinical entity that separates bacterial otitis externa from fungal otitis externa, which was poorly understood. Diagnosis relied solely on clinical observation, and treatment was empirical, often with an antiseptic or mechanical cleaning without targeting any antifungal therapy.(2)

## EPIDEMIOLOGY:

### 1. AFRICA

From an epidemiological perspective, it can be noted that otomycosis in Africa is influenced by where people live and how they live. The hot weather contributes to the development of otomycosis. The presence of longterm weatherwith adequate moisture will facilitate fungal growth in the ear canal. The presence of dust, water, and organic matter further contributes to otomycosis.The fungal etiology in African settings is diverse, involving both Molds and yeasts, with *Aspergillus* species—especially *A. Niger* and *A. flavus*—and *Candida* species being commonly implicated. The wide ecological distribution of these fungi in soil, air, and decaying vegetation facilitates repeated exposure and colonization of the ear canal. In many African communities, limited access to healthcare, delayed presentation, and widespread use of unprescribed topical agents or traditional remedies further predispose individuals to fungal overgrowth and chronic infection. From a clinical perspective, otomycosis in Africa often presents as a recurrent or persistent condition, frequently complicated by mixed bacterial–fungal infections, which can obscure diagnosis and delay appropriate treatment. Contributing host-related factors include local ear trauma, habitual ear cleaning practices, prior topical antibiotic use, and underlying systemic conditions that impair local or systemic immunity. Together, these environmental, behavioural, and healthcare-related factors define the distinctive clinical epidemiology of otomycosis in the African geographical context, underscoring the need for improved diagnostic awareness and targeted antifungal management strategies. Clinically, cases of otomycosis, as observed in Africa, could be recurring or chronic, often complicated by secondary infections resulting from mixtures of bacterial and fungal infections, thereby delaying diagnosis and treatment. Some contributing host-related factors include trauma to the ear, ear cleaning habits, prior use of antibiotics, and systemic diseases affecting immunity. This array of environmental, behavioural, and medical factors, therefore, makes up what is distinctive about clinical epidemiology as well as demonstrates the importance of greater diagnostic or treatment approaches based on antifungals. (6)

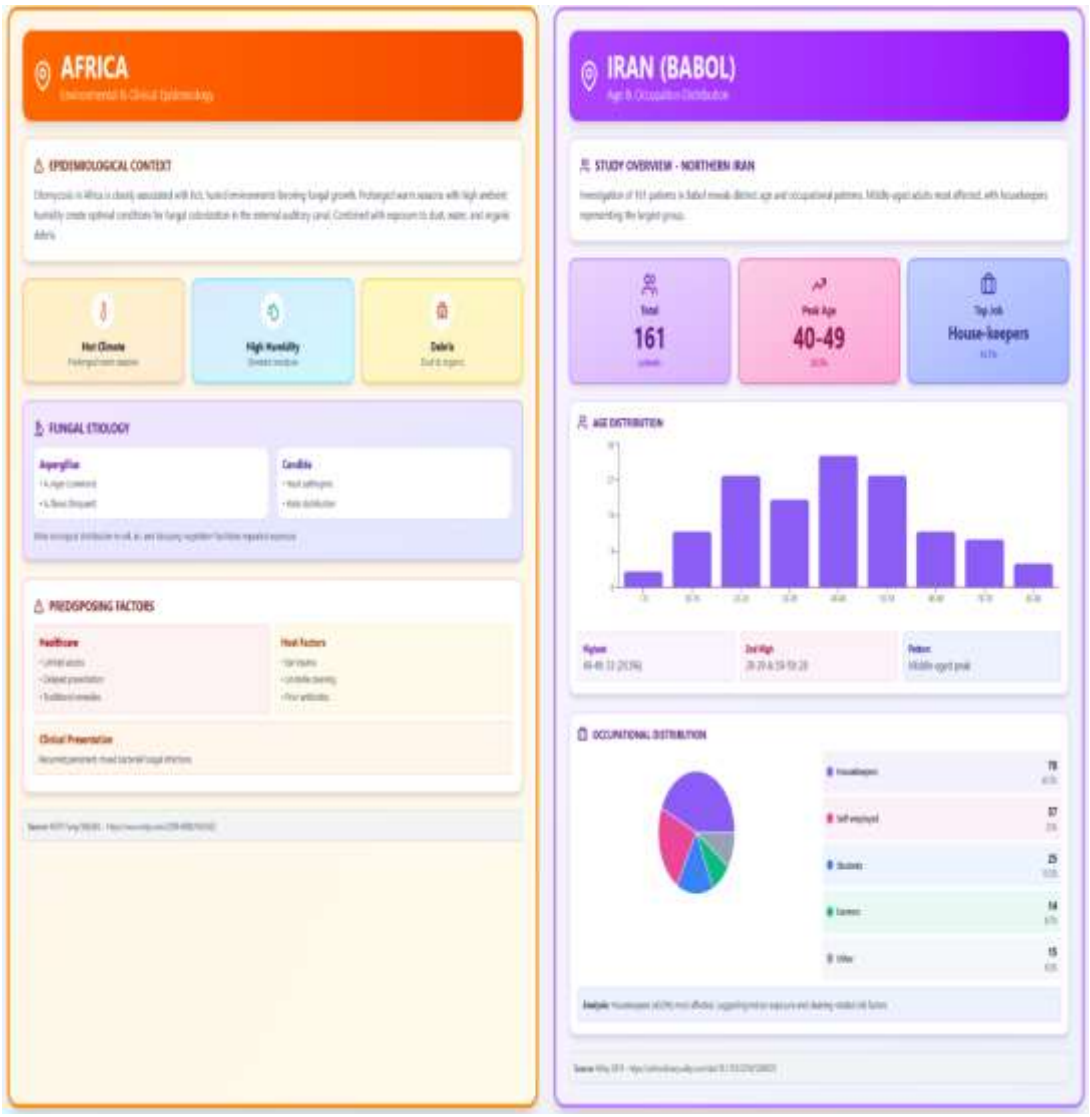



*Figure 1: Epidemiological description of Africa and Iran regions(6,7)*

**2. IRAN:**

In the northern part of Iran, notably in Babol, the investigation on the age distribution of otomycosis showed that middle-aged adults are most commonly affected. With 33 patients and a percentage of 20.5%, the highest rate was seen within the 40–49-year age group. They were followed by the group of 20–29 and 50–59-year-old age groups, each with 28 patients and 17.4%. Patients aged 30–39 years accounted for 13.7% (22 cases). Younger age categories represented lower frequencies: 8.7% for 10–19 and 60–69 years, each having 14 patients, while only 4 patients were aged between 1–9 years. The majority of patients among older adults were those aged 70–79 years, reaching 7.5% (12 patients), and 3.7% (6 patients) aged 80–89 years. Thus, the studied series total 161 patients, showing a higher prevalence among adults, particularly those in the fourth and fifth decades of life. The distribution of patients regarding occupation in Babol, Iran, north of Iran, revealed that the largest number of patients were housekeepers, accounting for 43.5% (70 patients) of the total. This is followed by self-employed patients, accounting for 23% (37 patients), and then students, accounting for 15.5% (25 patients). This was also followed by farmers, accounting for 8.7% (14 patients), and then those who were retired, accounting for 4.3% (7 patients) of the total patients. This study revealed a lower proportion of 2.5% (4 patients) for employees, 1.2% (2 patients) for the unemployed, and 1.2% (2 patients) for teachers. In total, 161 patients were studied in this study, and it is perceived that a high prevalence of otomycosis is found in housekeepers and self-employed patients.[7]

## 3. India

**A. TELANGANA :**

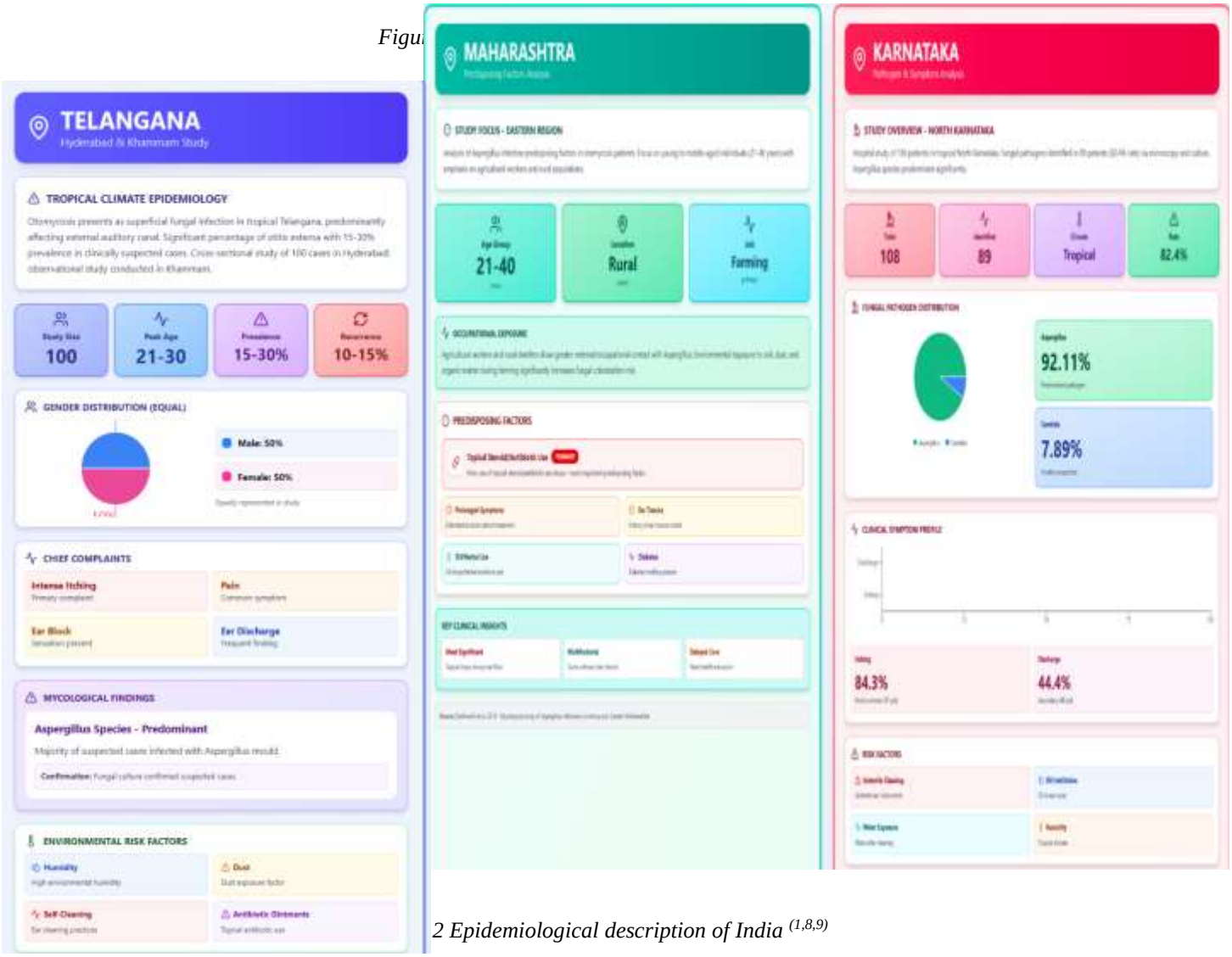
In the tropical climate of Telangana, otomycosis presents a superficial fungal infection commonly encountered, predominantly affecting the external auditory canal by displaying a distinct epidemiologic profile with regard to climatic and demographic risk factors as observed in the humid climate of India. Clinical and mycologic studies carried out by the department of ENT in Hyderabad and Khamma indicated that otomycosis presents a significant percentage of otitis externa. The prevalence of clinically suspected cases of external ear infection ranged from 15 to 30 percent. The age group of the infected people ranges from 21 to 30 years. In the cross-sectional study of 100 clinically diagnosed cases of myosis in Hyderabad, male and female cases were equally represented, with a common chief complaint of intense itching, pain, ear block, and ear discharge. The suspected cases were confirmed for the infection by the results of the fungal culture. The majority of the suspected cases were infected with a species of Aspergillus,

predominantly with the mould. In an observational study carried out in Khammam, the same microbiologic pattern was observed, and the epidemiologic pattern of the disease was reinforced with the observation of the environmental factors of humidity, dust, self-ear-cleaning practices, and the use of antibiotic ointments. Although the exact percentage of the disease in the community is not well established due to the hospital-based data, the occurrence of recurrent auto-myosis was observed in 10 to 15 % of the treated cases, especially among people with a persistent risk factor of diabetes, with moisture, and chronic explosion trauma. The regional findings of the ladies of the state of Telangana are in alliance with the overall epidemiologic data of the disease in the context of the broader epidemiologic data of the state of India, where the disease of otomycosis presents a superficial fungal infection commonly encountered in the tropical climate of the state with the presence of environmental factors playing a significant role in the reoccurrence of the disease.[1]

**B. MAHARASHTRA**

Analysis of predisposing factors in the development of Aspergillus infection in patients with otomycosis revealed that the most commonly affected age group was young to middle-aged individuals aged 21-40 years. Most of the patients were agricultural in occupation and rural dwellers, which showed a greater possibility of external/occupational contact leading to Aspergillus infection in the patients. Many patients with positive Aspergillus results in otomycosis had used topical steroid/antibiotic ear drops in the past, indicating this is an important predisposing factor. Many of these patients were noticed to have been having symptoms of their ears for a prolonged period of time. Other predisposing factors in unaltered form were noticed in some patients, like a history of trauma to the ears in the past, the use of oil drops/herbal medicine for medicinal purposes, as well as diabetes mellitus in some patients. In some cases of this patient category, there was no predisposed factor for the onset of the disease being present either. [8]

*Figu*




*2 Epidemiological description of India [1,8,9]*

**C. KARNATAKA**

In the tropical area of North Karnataka, the disease otomycosis has its own specific epidemiological characteristics. In the study conducted at the hospital involving 108 patients of otomycosis having symptoms of the disease, the fungal pathogens could be identified in 89 patients (82.4%) by microscopic examination and cultures, predominated by Aspergillus species (92.11%). The

study did not give the age and gender-wise distribution. But on the basis of similar studies conducted in the region, it is known that the disease mostly attacks the economically active group of young individuals. The ancillary regional data obtained from the regions of North Karnataka and the surrounding regions indicate the patient age group to be the young-to-middle-adult range, where humidity in the environment, as well as outdoor labour, increases the susceptibility to infections. The usage of unsterile instruments for the purpose of ear cleaning, instillation of oil, and subsequent use of water has been a core practice correlating with the increased susceptibility to the fungal infection in the environment, thus forming additional risk factors for susceptibility to the otomycosis infection. The demographic data thus correlates with the disease manifestations in the patient group, whereby the predominant symptom has been the itching component in 84.3% and the discharge component in 44.4% in the otomycosis cases documented in the patient data from the region of North Karnataka.[9]

## Signs and Symptoms:

Symptoms of Otomycosis include pruritus, pain, otorrhea, tinnitus, and hearing loss. The clinical appearance of aspergillosis and candidiasis of the ear canal is first considered. Aspergillosis is characterized by a mild inflammation of the deeper can lock the air. The lumen is full of the large sheets of keratin that have a moist tissue-like appearance. Whereas the candida usually has a greater edema and maceration of the deeper ear canal. The lumen may be filled with the curd-like material. It can lead to tympanic membrane perforation and can spread to the middle ear. [6]

## Mode of transmission of otomycosis:

Otomycosis is a type of external and superficial fungal infection that prevails in the external auditory canal, from where the fungal spores are produced and colonization and perforation processes begin in the warm and moist microenvironment found in the ear. This commonly damages the protective barrier offered by the external auditory canal. The most prevalent species of fungi involved in the irritation caused by otomycosis in humans are Aspergillus and Candida. The moisture in the local area is high, or the epithelial lining is wounded, in which a microenvironment is provided for the growth and reproduction of fungi. Tropical and subtropical regions characterized by high moisture levels have been established as one of the most important epidemiological risk factors, which will facilitate the dispersal of the fungal spores. The transmission is not typically from person to person, but an exogenous exposure due to the bacterial spores from the environment. It is caused by soil or infected water entering the external auditory canal and developing into an infection due to the compromised host defense. The contributing factors that play an important part in the transmission process of the infection, otomycosis, and will help in the host becoming susceptible include the regular cleaning of the ear, the topical antibiotic, and the topical steroids, which will alter the local microbial flora.

- Sharing the ear devices
- Humidity and moisture levels
- Ear manipulation
- Topical antibiotic and corticosteroid use
- Autoinnoculation [1]


*Figure 3: Etiopathogenesis of otomycosis* [10,11,12,13,14,15,16,17,18]

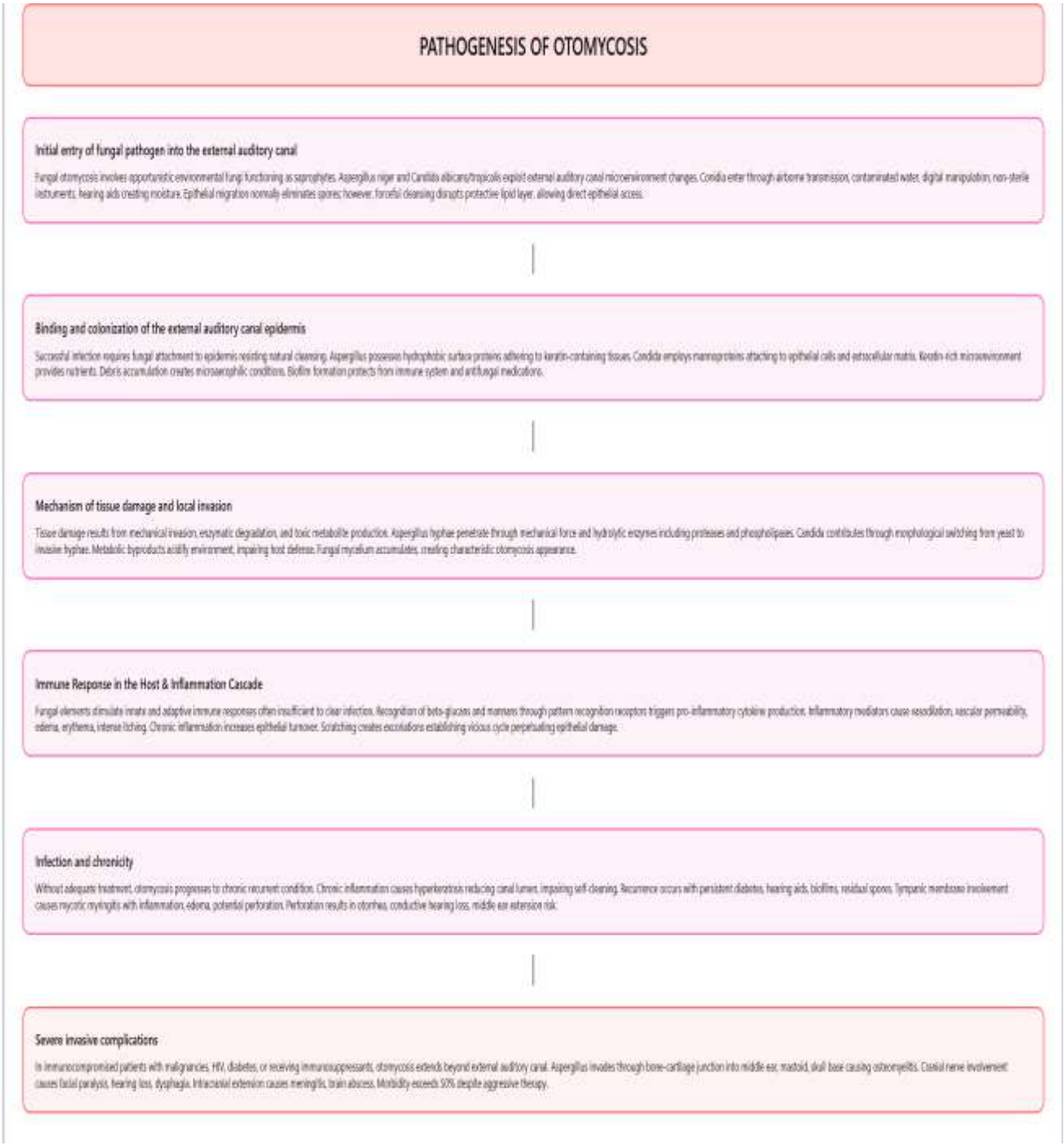



*Figure 4: Pathogenesis of otomycosis* [19]

## DIAGNOSIS:

Otomycosis is usually diagnosed by case history, symptoms, and otomicroscopic findings. However, when it is a recurrent, chronic, or severe infection, other methods such as microbial/histopathological examinations may need to be performed to aid in definitive diagnosis and organism isolation. Imaging studies, if ever, would involve looking at complications or ruling out other diagnoses. Diagnosis could be difficult due to overlapping symptoms of other types of otitis externa, especially in the case of mixed infections, where there is the presence of fungi together with other bacteria like Staphylococcus aureus, Pseudomonas, Coagulase-negative Staph, or Klebsiella. Laboratory diagnosis of cases relies on traditional mycologic techniques. Direct microscopy with native, KOH, or chloralactophenol wet mounts of the prepared slide can be a rapid and inexpensive way to detect yeast forms, blastoconidia, pseudohyphae, and hyphae. By microscopy, the sensitivity of the test remains low, and speciation and discrimination between colonization and infection cannot be done. Culture, or growing the fungus, is the gold standard for making a diagnosis. Serial cultures are necessary for identifying true pathogenicity as opposed to contamination. Culture, although labour-intensive, allows

for identification and susceptibility profiles. Bacterial and fungal cultures should both be performed during microbiological analysis. Sabouraud dextrose agar with appropriate selectors is used in yeast isolation, and incubation is carried out at 37°C for 48-72 hours. Chromogenic Candida agars enable the rapid identification of Candida and the presence of mixed Candida infections within a short period of time . For Molds, special agars free from cycloheximide and longer periods of incubation at temperatures of 26-28°C over 7-14 days should be used to avoid the problem of false-negative results due to poor incubation conditions.

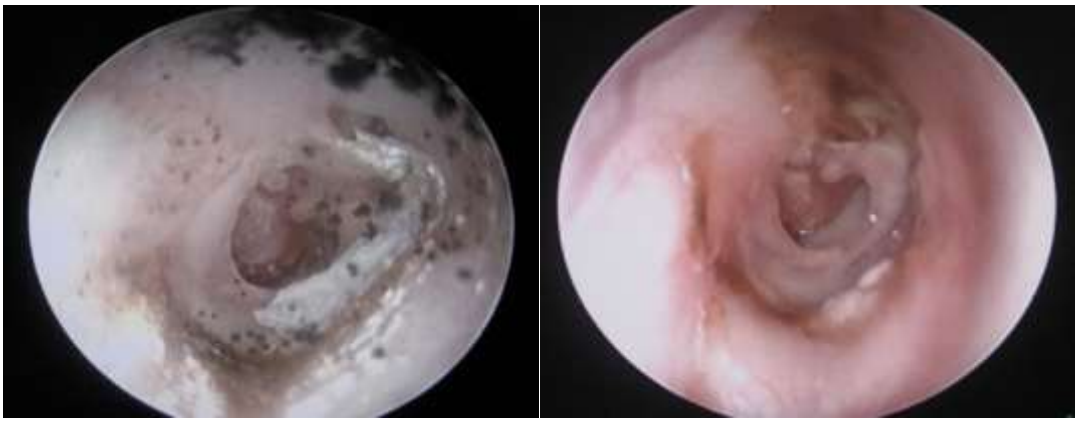


*Figure 5: Diagnosis Otoscopy [20]*

## TREATMENT

The management of otomycosis, in essence, revolves around the understanding that it is a superficial, localized, and non-destructive disease process; hence, the management and care of otomycosis involve strategies that are local in intent to control the fungal colonization process rather than any attempt to make use of antifungal agents to cure the disease process. The management of otomycosis begins with aural toilet—a process in which the fungal bodies, desquamated cell debris, and cerumen present in the ear canal are removed. This process not only reduces the fungal load but also helps to restore the normal microenvironment of the ear canal to its normal status. Once the process of aural toilet has been undertaken appropriately, antifungal agents alone are thought to be adequate to cure the disease process completely. Clotrimazole ranks high among the topical antifungal agents that have been identified to be effective in the management of otomycosis, primarily due to its broad antifungal activity against the common agents responsible for the disease process. Treating the systemic antifungal therapy in such uncomplicated condition cases offers no additional benefit and may expose the patient to unnecessary adverse effects and drug interactions. Clinical experience and published evidence confirm that short courses of topical clotrimazole following canal debridement offer fast symptom relief, low recurrence rates, and high patient compliance. Besides, clotrimazole is non-ototoxic and does not affect the epithelial integrity of the external auditory canal, making this medication safe even when the status of the tympanic membrane is doubtful. This monotherapy with clotrimazole will restore the normal canal environment and thereby effectively interrupt the disease process. Therefore, in uncomplicated otomycosis, topical clotrimazole alone is adequate, safe, and economic, and it therefore deserves first-line treatment status by reserving systemic therapy for those infrequent cases refractory or invasive.[22]

In France, nystatin has been recommended as the first-line local therapy for otomycosis, combined with oxytetracycline, polymyxin B, and dexamethasone for up to 15 days. Despite this agent's broad spectrum of activity against both yeasts and molds, there are conflicting views in the existing literature regarding its efficacy against Aspergillus spp., one of the most prevalent causative agents of otomycosis. Conversely, in the USA, for the treatment of uncomplicated cases of otomycosis, clotrimazole, being the topical imidazole, is recognized as the agent of choice. Hence, according to recent studies in India, the topical application of 1% clotrimazole cream can possibly cure cases of otomycosis. Yet there are studies showing results with smaller samples of cases refusing to categorize the agent as first-line because of lower efficacy in cases of Aspergillus-otomycosis . Other antifungals such as miconazole, bifonazole, isoconazole, and ciclopiroxolamine could also be employed in the treatment of otomycosis. Some studies showed a good in vitro response with efinaconazole, lanoconazole, and luliconazole against Aspergillus species; however, a reduction in susceptibility was observed to ravuconazole against A. tubingensis and A. niger in particular, as these strains are considered to be the predominant pathogens causing otomycosis.[6]

## CLOTRIMAZOLE MECHANISM OF ACTION:

Clotrimazole is a synthetic imidazole antifungal agent with broad-spectrum activity and is, to a great extent, used topically in the treatment of Candida infections, dermatophytosis, and other superficial fungal diseases. Its main antifungal action is fungistatic and is mediated through interference with the biosynthesis of ergosterol essential component of the fungal plasma membrane. Clotrimazole inhibits the enzyme 14-α-demethylase. This prevents the conversion of lanosterol to ergosterol, leading to depletion of cellular ergosterol along with accumulation of toxic sterol intermediates. Eventually, this increases membrane permeability, structural instability, and impairs fungal cell growth. Because ergosterol also has a hormone-like effect, promoting fungal proliferation, suppression of ergosterol synthesis rapidly and in a dose-dependent manner inhibits fungal replication. In addition to its antifungal effects, clotrimazole demonstrates in vitro activity at high concentrations against certain Gram-positive bacteria and some Trichomonas species. It also impairs cellular calcium homeostasis by inhibiting sarcoplasmic reticulum $Ca^{2+}$-ATPase and blocking calcium-dependent ion channels, accounting for some of its non-antifungal pharmacological effects.

## ADVERSE EFFECTS:

Clotrimazole is an antifungal drug that has a number of adverse effects and contraindications depending on the route of administration. If the drug is administered through the oral route, it can result in gastrointestinal manifestations such as itching, nausea, and vomiting. An abnormal liver function test is also a possibility in an individual taking the oral form of the drug, as it is estimated that more than 10% of patients taking the drug can experience such an abnormality. In the case of topical or localized applications of the drug, a burning sensation in the application site is a frequent complaint expressed by the patient. In addition to the above manifestation, other skin reactions such as rashes, urticaria, blisters, stinging, peeling, and swelling are experienced by the individual taking this drug.

Clotrimazole is contraindicated for patients who display hypersensitivity to azole-class antifungals or the excipients in certain preparations. For pregnant patients, the local treatment of vaginitis with clotrimazole causes less systemic absorption. Clotrimazole is a US FDA pregnancy category C drug. However, controlled studies conducted on pregnant patients using oral forms of clotrimazole were inadequate; nonetheless, teratogenic effects were not noted. Clotrimazole is now used during pregnancy.
Data on its secretion during breastfeeding is not very relevant in breastfeeding babies, although topical application poses very small risks to mother and baby. Drug interactions include elevated tacrolimus concentrations if there is excess use of clotrimazole, causing toxicity to the mother. Local side effects also include pain in the pelvis, headaches, irritation, and itching. Local adverse effects also include pain in the pelvis, headaches, irritation, and itching. Potency and effectiveness

## EFFECTS ON RECURRENT OTOMYCOSIS:

A lot has been researched and shown about the effectiveness and role of clotrimazole in the management and prevention of recurrent otomycosis infections. Many in vivo and in vitro studies have shown its high effectiveness and potent action on common fungi that can infect the ears and many infections caused by fungi all over the world. Many clinical trials have shown improvement in symptoms such as pain, itching, swelling, irritation, and edema after the administration of clotrimazole treatments to patients. In a study, patients who took clotrimazole experienced tremendous relief between the initial and follow-up evaluations and performed better than the controls. It is observed that the use of clotrimazole is most common among azoles in treating otomycosis, with efficacy ranging from 95% to 100%. However, there are some studies that report lower efficacy. Its advantage lies in the addition of bactericidal properties in mixed bacterial and fungal infections. More importantly, clotrimazole is non-toxic to the ears, and there are no clinical observations of ototoxicity. Various studies in diverse areas, including India, reveal quick clinical cure in most patients, mostly within 1–2 weeks, especially with mechanical debridement. Comparative studies reveal the effectiveness of clotrimazole to be equal to or better than other drugs such as povidone iodine, gentian violet, and nystatin. Both single-dose and topical treatments are effective. Relapse prevention is particularly successful, although relapse is to be expected in the case of patients having canal or tympanic membrane pathology, wherein the use of clotrimazole drops may reduce the chances of recurrence.[21]

## Conclusion:

Otomycosis is a fungal infection of the external ear canal and eardrum, most commonly found in hot, humid climates where species such as Aspergillus and Candida thrive. The condition is often triggered by factors such as frequent swimming, air manipulation, or underlying health issues like diabetes and immunosuppression in patients. Patients typically experience intense, itching pain and hearing loss, which clinicians diagnose through autoscopy and laboratory methods like KOH mounts or cultures. Effective management requires a professional ear, cleaning, and topical antifungal medications, though the development of a fungal biofilm makes preventing reoccurrence a significant clinical challenge.

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