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Original Article

Prevalence and Antifungal Susceptibility Pattern of Candida Species in Oral Candidiasis

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ABSTRACT

Introduction: Oral infections continue to represent a significant public health challenge, contributing substantially to morbidity and healthcare costs worldwide. **Aim**: To assess the prevalence and species distribution of Candida in culture-positive cases of oral candidiasis and to evaluate their antifungal susceptibility pattern to commonly used antifungal agents. **Methodology**: This cross-sectional study was conducted in the Department of dentistry at SMS hospital from January 2023. **Result**: Among 60 culture-positive patients, oral candidiasis was more common in the 31–45 years age group with slight male predominance, and pseudomembranous candidiasis was the most frequent clinical type. Candida albicans was the predominant isolate (60%), while non-albicans species showed higher fluconazole resistance, with amphotericin B demonstrating the highest overall sensitivity. **Conclusion**: Oral candidiasis in the present study was predominantly caused by Candida albicans, though a significant proportion of non-albicans species with higher fluconazole resistance was observed. Routine species identification and antifungal susceptibility testing are essential for effective management and prevention of antifungal resistance.

Keywords: *oral candidiasis, antifungal susceptibility, culture sensitivity.*

INTRODUCTION

Oral infections continue to represent a significant public health challenge, contributing substantially to morbidity and healthcare costs worldwide[1]. These infections can lead to severe pain, difficulty in eating and speaking, tooth loss, aesthetic disfigurement, and in advanced or immunocompromised cases, life-threatening systemic complications. Among the various oral infectious conditions, oral candidiasis holds particular clinical importance due to its opportunistic nature and increasing incidence across diverse patient populations.[2] Over the past few decades, the occurrence of oral candidiasis has risen markedly, especially with the growing number of individuals affected by immunocompromising conditions[3]. The surge in human immunodeficiency virus (HIV) infections and the acquired immunodeficiency syndrome (AIDS) epidemic since the late twentieth century significantly contributed to heightened awareness and research into Candida-associated oral diseases. Currently, millions of cases of oral candidiasis are reported annually across the globe, making it one of the most common fungal infections affecting humans.Historically, oral candidiasis has been recognized for centuries as a disease that primarily affects individuals with underlying systemic compromise.[3] The condition is caused by Candida species, commensal yeasts that normally inhabit the oral cavity but can transform into pathogenic organisms when host defense mechanisms are impaired. Although Candida albicans remains the predominant etiological agent, there has been a noticeable shift in recent years toward non-Candida albicans Candida species, including Candida glabrata, Candida tropicalis, and Candida krusei[4]. These non-albicans species are increasingly isolated in clinical practice and are often associated with reduced susceptibility to commonly used antifungal agents. Oral candidiasis typically presents in distinct clinical forms, such as pseudomembranous candidiasis characterized by removable white plaques, erythematous candidiasis presenting as red inflamed mucosa, and chronic hyperplastic lesions. Accurate clinical recognition supported by laboratory confirmation is essential for appropriate management.The development of oral candidiasis is rarely an isolated event and is frequently linked to systemic or local predisposing factors.[3] Conditions such as diabetes mellitus, malignancy, prolonged antibiotic therapy, corticosteroid use, chemotherapy, denture wearing, tobacco use, and other states

of immunosuppression significantly increase the risk of Candida overgrowth. In diabetic patients, elevated salivary glucose levels and altered immune responses contribute to increased Candida colonization and susceptibility to infection.[5] However, colonization alone does not necessarily result in active disease; progression to symptomatic infection typically occurs when host immunity is compromised. Therefore, early diagnosis and timely antifungal intervention are crucial to prevent complications and recurrence.In recent years, growing concern has emerged regarding antifungal resistance among Candida species[6]. The increasing use and, at times, misuse of antifungal agents have contributed to reduced susceptibility, particularly among non-albicans species.[7] Resistance to azole antifungals, especially fluconazole, poses therapeutic challenges and may result in persistent or recurrent infections. Furthermore, oral Candida colonization has been associated not only with local disease but also with potential systemic implications, particularly in elderly or medically compromised individuals.

AIM

To assess the prevalence and species distribution of Candida in culture-positive cases of oral candidiasis and to evaluate their antifungal susceptibility pattern to commonly used antifungal agents.

METHODOLOGY

This cross-sectional study was conducted in the Department of Microbiology in collaboration with the Department of of dentistry at SMS hospital from January 2023. The study was approved by the Institutional Ethical Committee, and informed consent was obtained from all participants prior to sample collection. A total of 60 patients clinically diagnosed with oral candidiasis and confirmed positive for Candida species by culture were included in the study. Patients presenting with signs and symptoms suggestive of oral candidiasis such as white curd-like plaques, erythematous lesions, burning sensation, angular fissures, or chronic hyperplastic lesions were examined clinically. Oral swab samples were collected aseptically from the lesion site using sterile cotton swabs and transported immediately to the microbiology laboratory.

The samples were inoculated onto Sabouraud Dextrose Agar (SDA) and incubated at 37°C for 24–48 hours. Identification of Candida species was performed based on colony morphology, Gram staining, germ tube test, and chromogenic agar differentiation methods. Further species confirmation was done using standard biochemical tests where required.

Antifungal susceptibility testing was carried out for all 60 confirmed Candida isolates using the disc diffusion method in accordance with CLSI guidelines. The antifungal agents tested included Fluconazole, Itraconazole, Nystatin, and Amphotericin B. The zones of inhibition were measured and interpreted as sensitive or resistant according to standard criteria.

Demographic details including age and gender, along with clinical type and associated risk factors such as diabetes mellitus, denture use, tobacco habit, prolonged antibiotic use, and immunocompromised status were recorded using a structured proforma. The collected data were tabulated and analyzed using descriptive statistics, expressed in frequencies and percentages.

Patients clinically diagnosed with oral candidiasis and confirmed culture positive for Candida species were included in the study. Both male and female patients of all age groups were considered eligible. Patients who provided informed consent were included.

Patients who were culture negative for Candida species were excluded from the study. Patients currently undergoing antifungal therapy, those unwilling to provide consent, and patients with incomplete clinical data were also excluded.

RESULT

Table 1: Age Distribution of Study Population (n = 100)

Age Group (Years)	Number of Patients	Percentage (%)
18–30	10	16.7%
31–45	20	33.3%
46–60	18	30%
>60	12	20%

Among the 60 culture-positive patients, the majority belonged to the 31–45 years age group (33.3%), followed by 46–60 years (30%). The least affected group was 18–30 years (16.7%), while patients above 60 years accounted for 20% of cases.

Table 2: Gender Distribution (n = 60)

Gender	Number of Patients	Percentage (%)
Male	32	53.3%
Female	28	46.7%

Out of the 60 culture-positive patients, 32 (53.3%) were males and 28 (46.7%) were females. A slightly higher prevalence of oral candidiasis was observed among males compared to females.

Table 3: Clinical Types of Oral Candidiasis (n = 60)

Clinical Type	Number of Cases	Percentage (%)
Pseudomembranous Candidiasis	26	43.3%
Erythematous Candidiasis	18	30%
Angular Cheilitis	10	16.7%
Chronic Hyperplastic Candidiasis	6	10%

Among the 60 confirmed cases, pseudomembranous candidiasis was the most common clinical presentation (43.3%), followed by erythematous candidiasis (30%). Angular cheilitis accounted for 16.7% of cases, while chronic hyperplastic candidiasis was the least common type (10%).

Table 4: Predisposing / Risk Factors (n = 60)

Risk Factor	Number of Patients	Percentage (%)
Diabetes Mellitus	20	33.3%
Tobacco Use	15	25%
Denture Wearers	12	20%
Prolonged Antibiotics	8	13.3%
Immunocompromised State	5	8.4%

Among the identified risk factors, diabetes mellitus was the most common (33.3%), followed by tobacco use (25%) and denture wearing (20%). Prolonged antibiotic use (13.3%) and immunocompromised status (8.4%) were less frequently associated with oral candidiasis.

Table 5: Distribution of Candida Species (n = 60)

Candida Species	Number of Isolates	Percentage (%)
Candida albicans	36	60%
Candida tropicalis	10	16.7%
Candida glabrata	8	13.3%
Candida krusei	6	10%

Among the 60 isolates, Candida albicans was the predominant species (60%), followed by Candida tropicalis (16.7%). Candida glabrata accounted for 13.3% of cases, while Candida krusei was the least common isolate (10%).

Table 6: Antifungal Susceptibility Pattern (n = 60)

Antifungal Drug	Sensitive (n, %)	Resistant (n, %)
Fluconazole	42 (70%)	18 (30%)

Itraconazole	48 (80%)	12 (20%)
Nystatin	54 (90%)	6 (10%)
Amphotericin B	57 (95%)	3 (5%)

Antifungal susceptibility testing showed that Amphotericin B (95%) and Nystatin (90%) exhibited the highest sensitivity among the isolates. Fluconazole demonstrated comparatively higher resistance (30%), followed by Itraconazole (20%).

Table 7: Species-wise Fluconazole Resistance

Species	Total	Resistant	Resistance %
C. albicans	36	6	16.7%
C. tropicalis	10	4	40%
C. glabrata	8	5	62.5%
C. krusei	6	3	50%

Species-wise analysis revealed that C. glabrata showed the highest resistance (62.5%), followed by C. krusei (50%) and C. tropicalis (40%). C. albicans demonstrated the lowest resistance rate at 16.7%.

DISCUSSION

In our study, the age distribution of culture-positive patients demonstrated that the majority of cases belonged to the 31–45 years age group, accounting for 20 patients (33.3%). This was followed by the 46–60 years age group with 18 patients (30%). Patients aged above 60 years constituted 12 cases (20%) of the total study population. The younger age group of 18–30 years included 10 patients, representing 16.7% of cases. These findings indicate that oral candidiasis was more prevalent among middle-aged adults in the present study.

In our study, a total of 60 culture-positive patients were evaluated for gender distribution. Among them, 32 patients (53.3%) were males, while 28 patients (46.7%) were females. A slightly higher prevalence of oral candidiasis was observed among male patients compared to females. This difference, however, was not markedly significant but indicates a marginal male predominance. The higher occurrence in males may be attributed to associated risk factors such as tobacco use, poor oral hygiene, or occupational exposure. Černáková L, et al[8] The average age of the cohort was 51.9 ± 19.7 years (female: 48.6 ± 21.0 and male: 52.3 ± 20.4). These results indicate that the oral Candida spp. prevalence (in this hospital and period) was higher among males than among females (61.9% vs. 38.1%).

In our study, pseudomembranous candidiasis was the most common clinical presentation, accounting for 26 cases (43.3%) among the 60 culture-positive patients. Erythematous candidiasis was the second most frequent type, observed in 18 patients (30%). Angular cheilitis was identified in 10 cases (16.7%), representing a moderate proportion of the study population. Chronic hyperplastic candidiasis was the least common presentation, seen in 6 patients (10%). The findings indicate that acute forms of oral candidiasis were more prevalent than chronic variants. Pseudomembranous candidiasis emerged as the predominant clinical type in our study population.

In our study, diabetes mellitus was the most common predisposing factor associated with oral candidiasis, observed in 33.3% of patients. Tobacco use was the second most frequent risk factor, accounting for 25% of cases. Denture wearing was identified in 20% of patients, indicating its significant role in Candida colonization. Prolonged antibiotic therapy was reported in 13.3% of the study population, suggesting alteration of normal oral flora as a contributing factor. Immunocompromised states were present in 8.4% of patients. Overall, these findings show the strong association between systemic and local risk factors and the development of oral candidiasis.

In our study, Candida albicans was the predominant species isolated, accounting for 36 (60%) of the total 60 isolates. Among the non-albicans Candida species, Candida tropicalis was the most frequently identified, representing 10 cases (16.7%). Candida glabrata was isolated in 8 patients (13.3%), while Candida krusei accounted for 6 cases (10%). The overall findings indicate that although C. albicans remains the major etiological agent of oral candidiasis, non-albicans Candida species constitute a significant proportion of infections. This highlights the shifting trend toward increasing isolation of non-albicans species in clinical practice. Such distribution emphasizes the importance of species-level identification for appropriate antifungal management.Shafi et al[9] Candida albicans was the most frequently isolated species (64%). Highest resistance was seen with ketoconazole (18%). Except one C. tropicalis, all the isolates were sensitive to amphotericin B.

In our study, antifungal susceptibility testing of the 60 Candida isolates revealed variable sensitivity patterns among the tested drugs. Fluconazole showed sensitivity in 70% of isolates, while 30% demonstrated resistance. Itraconazole exhibited a higher sensitivity rate of 80%, with 20% resistance observed. Nystatin was effective against 90% of isolates, showing minimal resistance (10%). Amphotericin B demonstrated the highest sensitivity (95%) with only 5% resistance. Overall, polyene antifungals showed better efficacy compared to azole drugs in the present study.Preethaa Sri P et al[10] Most of the C. albicans isolates were sensitive to fluconazole, voriconazole (83.33 %, 10/12), amphotericin B (91.67 %, 11/12), and itraconazole. Fluconazole resistance was noted in 50 % (2/4) of the control isolates. Among the non-albicans Candida species, C. parapsilosis and C. tropicalis were found to be sensitive to all antifungals except caspofungin. All C. glabrata isolates were resistant to fluconazole (100 %). The C. krusei isolate was resistant to fluconazole, amphotericin B, caspofungin, and flucytosine.

In our study, species-wise analysis of fluconazole resistance revealed varying resistance patterns among different Candida isolates. C. albicans showed relatively low resistance, with 6 out of 36 isolates (16.7%) being resistant. In contrast, higher resistance was observed among non-albicans species. C. tropicalis demonstrated 40% resistance, while C. krusei showed 50% resistance to fluconazole. The highest resistance rate was noted in C. glabrata, where 62.5% of isolates were resistant. These findings indicate that non-albicans Candida species exhibit greater resistance to fluconazole compared to C. albicans in our study population.Černáková L, et[8] al After performing the antifungal susceptibility tests, all isolates were sensible to AmB, but several (n = 11) had resistance to 5FC (52.4%), to Flu (28.5%, n = 6) and Vcz (intermediate profile: 0.95%, n = 2). This means that 81.6% of the collected strains had some resistance to one or more antifungal drugs, which is clinically noteworthy.

CONCLUSION

The present study demonstrated that oral candidiasis was more prevalent among middle-aged adults, with a slight male predominance observed among culture-positive patients. Pseudomembranous candidiasis emerged as the most common clinical presentation, indicating that acute forms were more frequent than chronic variants in the study population. Diabetes mellitus was identified as the leading predisposing factor, followed by tobacco use and denture wearing, highlighting the significant role of systemic and local risk factors in disease development.

Candida albicans remained the predominant species isolated; however, a considerable proportion of infections were caused by non-albicans Candida species, indicating a shifting epidemiological trend. Antifungal susceptibility testing revealed higher efficacy of polyene drugs, particularly amphotericin B and nystatin, compared to azole antifungals. Notably, increased fluconazole resistance was observed among non-albicans species, especially Candida glabrata and Candida krusei.

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