Original Article

Oropharyngeal candidiasis and *Candida* colonization in HIV positive patients in northern India

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Abstract

Introduction: Oropharyngeal candidiasis (OPC) is the most common opportunistic fungal infection reported in human immunodeficiency virus (HIV) positive patients worldwide. This prospective study was undertaken to investigate OPC and *Candida* colonization (CC) and their correlation with $CD4^+$ cell counts and antiretroviral therapy (ART) in HIV-positive patients.

Methodology: In total, 190 HIV-positive patients were enrolled for study in three groups as follows: Group A, 90 patients without ART; Group B, 100 patients undergoing treatment with ART; and Group C, 75 HIV-negative control patients. All HIV patients underwent clinical examination and were subjected to $CD4^+$ cell counts. Swabs were collected from the oral cavity of all individuals and plated on Sabouraud's dextrose agar. Identification of *Candida* species was performed by conventional methods.

Results: *Candida* species were isolated in 84/190 (44.2%) and 20/75 (26.6%) of the HIV-positive subjects and controls respectively ($p<0.01$). OPC was noted in 21/190 (11%) of the HIV-positive patients. *Candida albicans* was the most frequently isolated species. Patients with $CD4^+$ cell counts ≤ 200 cells/mm^3 were significantly ($p<0.001$) more frequently colonized (37/63; 58.7%) and infected (18/21; 85.7 %) with *Candida* species. *Candida* species was seen in patients with CC and OPC with $CD4^+$cell counts between 201 and 500 (21/63; 33.4% vs 3/21; 14.3%) and > 500 cell/mm^3 (5/63; 7.9% versus 0/21 0%) respectively.

Conclusion: OPC and *Candida* colonization occur more frequently in HIV-positive patients with $CD4^+$ cell counts ≤200 cell/mm^3. ART significantly reduces OPC. *C. albicans* is the most frequently isolated species in both OPC and colonization, suggesting endogenous infection.

Key words: Orophayngeal candidiasis (OPC); *Candida* colonization; antiretroviral therapy; $CD4^+$cells; HIV

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Introduction

The oral cavity is colonized by *Candida albicans* or other *Candida* species in 40% to 60% of healthy persons [1]. In immunocompetent individuals, *Candida* species are mostly transient flora. Many factors contribute to the development of oropharyngeal candidiasis (OPC) including malnutrition, poor oral hygiene, dental malocclusion, and immunosuppression [2]. The current epidemic of human immunodeficiency virus (HIV) is a major cause of immunosuppression. According to the Joint United Nations Programme (2009) on HIV/AIDS [3] and the National AIDS Control Organization (2008) [4], there are an estimated 2.4 million cases of HIV infection worldwide and 22.7 per 100,000in India respectively. The World Health Organization (WHO) predicts that India will have one of the largest populations of HIV/AIDS patients worldwide in coming decades. OPC has been described as the most frequent opportunistic fungal infection among HIV-positive patients and it has been estimated that more than 90% of HIV-positive patients develop this often debilitating infection at some time during the progression of their disease [5,6]. The presence of *Candida* species in the oral cavity of HIV-positive patients is an indicator of subsequent development of OPC [7]. HIV-positive patients experience recurrent episodes of OPC and oesophageal candidiasis. As immunodeficiency progresses, these patients may also receive multiple courses of antifungal drugs contributing to antifungal resistance. In these patients, antifungal agents are also

less efficacious and take longer to achieve a clinical response [8].

Until recently, *C. albicans* was reported as the predominant species in OPC but recent publications suggest that non-*albicans Candida* species are now emerging [1,9]. There is a paucity of microbiological studies on OPC and *Candida* colonization (CC) in HIV patients from India; therefore, the present study was conducted to determine the profiles of CC and OPC and their correlation with $CD4^+$ cell counts and antiretroviral therapy (ART) in HIV patients.

Methodology

Study population

This hospital-based prospective observational study was conducted between August 2007 and July 2008. Patients attending the ART Centre and the Integrated Counseling and Testing Centre (ICTC) at Chhatrapati Shahuji Maharaja Medical University (CSMMU), Lucknow, were enrolled for the study. A total of 190 HIV-positive patients were enrolled after they provided informed written consent. Seventy-five HIV-negative subjects in the same age group and socioeconomic status were enrolled as study controls. The study was approved by the institutional ethical clearance committee. Individuals with diabetes mellitus or other systemic diseases, pregnant women, smokers, dentures/orthodontic device users, and those on antibiotics and/or on antifungal treatment in the preceding three months were excluded.

HIV serostatus of the study group was determined using a commercially available enzyme linked immunosorbent assay (ELISA) (HIV-1 Enzaids, Span Diagnostics Ltd, Udhna, Surat, India) and three rapid antibody tests manufactured by CombAids-RS Span Diagnostics Ltd, Surat, India; Retrocheck HIV, QUAL proDiagnostics, Goa, India and Acon Biotech Prolink, San Diego, CA, USA, following NACO recommended algorithms [10]. A CD4+ cell count using the Fluorescent Antibody Cell Sorter (FACS, Becton Dickinson, Singapore, BD) Count system was performed in all enrolled HIV-positive patients.

Clinical and microbiological assessment of subjects

An oral examination was performed and suspected lesions were clinically evaluated by the Faculty of Dental Sciences. *Candida* colonization was defined as isolation of *Candida* species from the oral cavity without the presence of oral lesions. All patients who had oral lesions and from whom *Candida* species were isolated were considered to have OPC. Recent $CD4^+$ cell counts and a history of intake of ART were noted for all HIV-positive patients. A single oral swab was collected from each study participant by passing a sterile swab firmly across the buccal mucosa, floor of mouth, dorsal surface of the tongue in cases of asymptomatic patients, and from the base of the oral lesion in cases of symptomatic patients. Swabs were cultured on Sabouraud's dextrose agar (SDA) with chloramphenicol 0.5g/l, then incubated at 37°C and observed daily for seven days. Pure growth of *Candida* species was considered for analysis. *Candida* was identified by conventional tests and species identification was performed using the germ tube test, growth on CHROMagar *Candida* Medium (HiMedia, Mumbai, India), and sugar assimilation tests [11,12].

Statistical analysis was conducted by using the chi-square test. Data were analyzed with SPSS software version 20 (IBM SPSS, Chicago, USA).

Results

In the present study, 190 HIV-positive patients were designated into two groups: group A (n = 90) without ART and group B (n = 100) with ART. The demographic data and clinical profile of these patients is shown in Table 1. The median duration of ART was two years (range, 1.5 months to 6 years). Overall, *Candida* species was isolated from the oral cavity in 84/190 (44.2%) HIV-positive patients and in 20/75 (26.6%) of HIV-negative patients. The difference was significant ($p < 0.01$). Of the 84 HIV-positive patients with *Candida* species, 41 (45.5%) were from Group A and 43 (43.0%) were from the Group B. Twenty-one (11%) HIV-positive patients had oral lesions in the oropharyngeal cavity and *Candida* species were isolated on culture.

Five different clinical presentations of OPC were noted on examination in HIV-positive patients (Table 1). Pseudomembranous candidiasis was the most common clinical presentation of OPC. *C. albicans* was the most frequent species isolated in both HIV-positive (76/84; 90.5%) and HIV-negative patients (20/20; 100%). It was also the most frequently isolated yeast (95.2%) in all clinical presentations of OPC. Non-*albicans Candida* was isolated in only one patient with OPC (1/21; 4.76% *C. tropicalis*) and seven patients with colonization (7/63; 11.1%). The correlation between oral CC and OPC with $CD4^+$ cell counts in HIV-positive patients is shown in Table 1. The range of $CD4^+$ cell counts in colonized and non-colonized HIV-positive patients was 2 to 776 cells/mm3 (median = 183) and 8 to 756 cells/mm3 (media n = 247), respectively. CC was seen in 37 (58.7%), 21 (33.4%) and 5 (7.9%) HIV-positive

Table 1. Profile of HIV patients with *Candida* colonization and infection and its correlation with ART and $CD4^+$ count

Demographic Data	HIV Positive patients			Group C HIV Negative patients N = 75
	Total N = 190	Group A N = 90	Group B N = 100	
Male	116 (61)	48 (53.3)	68 (68)	57 (68)
Age range (Years)	6-55	20-55	6-50	6-64
Total *Candida* isolates	84 (44.2)	41 (45.5)	43 (43)	20 (26.6) *
Oral *Candida* Colonization (CC)	63 (33.1)	25 (27.8)	38 (38)	20 (26.7)
$CD4^+$ cell Count				
≤ 200				$CD4^+$ count not done
201-500	37 (58.7)	14 (56)	23 (60.5)	
> 500	21 (33.4)**	9 (36)	12(31.6)	
	05 (7.9)**	02 (8)	03 (7.9)	
Oro-pharyngeal candidiasis (OPC)	21 (11)	16 (17.8)	5 (5)***	0
$CD4^+$cell count				
≤ 200	18 (85.7) **	13 (81.2)	5 (100)	
201-500	03 (14.3) **	03 (18.8)	0	
> 500	0	0	0	
Types of oral lesions				
Pseudomembranous (P)	16 (76.2)	12 (75)	4 (80)	
Erythematous (E)	0	0	0	
Angular chelitis (AC)	2 (9.5)	1 (6.2)	0	
AC +E	1 (4.8)	1 (6.2)	0	
AC + E + P	2 (9.5)	2 (2.2)	1 (20)	
***Candida* species isolated**				
C. albicans	76 (90.5)	40 (97.6)	36 (83.8)	20 (100)
C. tropicalis	1 (1.2)	0	1 (2.3)	-
C. glabrata	4 (4.8)	0	4 (9.3)	-
C. krusei	1 (1.1)	0	1 (2.3)	-
C. kefyr	2 (2.4)	1 (2.4)	1 (2.3)	-

Note: All figures in parentheses represent percentages.

*$p < 0.01$ when compared with total HIV patients

**$p < 0.001$ when compared with $CD4^+$ cell count ≤ 200

***$p < 0.05$ when compared to Group A

patients with $CD4^+$ cell counts ≤ 200cells/mm^3, between 201 and 500 cells/mm^3 and more than 500cells/mm^3, respectively ($p < 0.001$). The majority of HIV-positive patients with OPC (18/21; 85.7%) had a $CD4^+$cell count ≤ 200 cell/mm^3 ($p < 0.001$). OPC was not seen in patients with $CD4^+$ cell counts greater than 500 cells/mm^3. In the present study, OPC was found to be significantly higher in patients in Group A (16/90; 17.8%) as compared to Group B (5/100; 5%), ($P < 0.05$). Antiretroviral therapy did not influence the status of colonization.

Discussion

Asymptomatic carriage of *Candida* species in the oral cavity is found irrespective of the immune status of individuals. Many studies have been conducted on oral CC in healthy and immunocompromised individuals. Due to differences in the sample collection techniques used, time and frequency of

sampling, yeast assessment methods, and the study population, results from the studies are not comparable. In addition, CC rate can be affected by several factors such as hospitalization, abnormal nutrition, and smoking [2]. Oral CC in HIV-positive asymptomatic patients has been reported and is known to be higher than in patients in other risk groups such as diabetes mellitus or other systemic disease [13]. Similarly, in our study, the isolation of *Candida* was significantly higher in the HIV-positive group compared to that in the controls. The prevalence of OPC (11%) and CC (33%) in HIV-positive patients in the present study was lower compared to that in other studies (62.6% to 81%) [14-17]. The reason for the low isolation rate in the present study could be explained by single sampling performed in this study as compared to multiple sampling in other investigations.

OPC infections are the most common of opportunistic infections in HIV-positive patients, occurring in up to 90% of patients during the course of the disease [13]. In India, OPC is reported to be the second most common opportunistic infection in HIV-positive patients [18]. Three clinical presentations of OPC have been commonly reported in HIV-positive patients: pseudomembranous, erythematous and angular chelitis [17,19]. In our study, acute pseudomembranous candidiasis (exudative) was the most common form of OPC (Table 1), while angular chelitis may be part of vitamin deficiency superimposed with *Candida* infection seen in 9.5% of the patients. These results are in concordance with those result of several other studies [16,20]. *C. albicans* was also the predominant species isolated from the oral cavities of the patients in the control group.

In HIV-positive patients with OPC, *C. albicans* is the most frequently identified species; however, non-*albicans Candida* has also been reported recently [20,21]. *C. albicans* was the most frequent species isolated from colonized and infected HIV-positive subjects (90.5%) in our study (Table 1). In the present study, a relatively small proportion (9.5%) of isolates were non-*albicans Candida*. In a study conducted in Italy, Barchiesi *et al*. described an increase in the frequency of isolation of non-*albicans Candida* species from 3% to 4% of isolates in 1988/1989 to 16% to 18% of isolates in 1990/1991 [15]. Similarly, in another Italian study, Morace *et al*. (1990) found that 25% of the yeast species isolated from persons with AIDS were non-*albicans Candida* [22]. In Spain, Masia *et al*. evaluated 153 HIV-positive patients and found that 21% of these patients had non-*albicans Candida*, the most common being *C. glabrata* [23]. Table 2 shows the distribution of *Candida* species isolated from HIV-positive patients with OPC from

Table 2. Studies on OPC in HIV infected patients from India in last decade

Study Group	Duration of study	Patient size and characteristics	Predominant species
Delhi (Lattif AA *et al*.) [24]	1999-2001	75 (OPC)	*C. albicans* (86%) *C. parapsilosis* (8%) *C. glabrata and C. krusei* (3%) *C. dubliniensis* (0%)
Chennai (Menon T *et al*.) [25]	2001	46 (Infected or colonized)	*C. albicans* (73.9%) *C. tropicalis* (21.7%) *C. dubliniensis* (0%)
Mumbai (Baradkar VP *et al*.) [21]	2005-2008	40 (OPC)	*C. albicans* (70%) *C. parapsilosis* (15%) *C. glabrata* (7.5%) *C. tropicalis* (5%) *C. dubliniensis* (2.5%)
Karnataka (Nadagir SD *et al*.) [26]	2008	132 Patients 135 Isolates(OPC)	*C. albicans* (66.6%) Non albicans *Candida* (33.3%) *C. dubliniensis* (48.9%)
Lucknow Present study	2007-2008	21 (OPC)	*C. albicans* (95.2%) *C. tropicalis* (4.76%) *C. dubliniensis* (0%)

OPC: Oropharyngeal candidiasis

India in the last decade [21,24-26]. The findings showed that in India *C. albicans* continue to be the predominant pathogen and non-*albicans Candida* has been reported in approximately 14% to 30% of patients.

The reports of an association between $CD4^+$ cell counts and OPC/CC are also contradictory; Costa *et al*. did not find a significant correlation between CC and $CD4^+$ cell counts, as 16.25%, 61.2% and 22.6% of the patients in their study had $CD4^+$ cell counts ≤ 200, 201 to 500 and more than 500 respectively [27]. Little correlation was also observed by Barchiesi and colleagues, with a median $CD4^+$ cell count of397cell/mm^3 and 442 cells/mm^3 in colonized and non-colonized their patients, respectively [28]. Schoofs *et al*., however, reported a significant relationship between CC and $CD4^+$cell counts less than 200 cell/mm^3 [29]. Fong and colleagues also found a strong correlation between asymptomatic CC, the development of thrush, and $CD4^+$ cell counts [30]. OPC in HIV-positive persons keeps recurring as the immunity decreases. In our study, CC was significantly higher in the group with $CD4^+$cell counts ≤ 200 cell/mm^3 ($p < 0.001$), suggesting that the group is prone to develop OPC.Prevention of opportunistic infections in patients with HIV is important because in all HIV-infected individuals, the risk of infection increases as the absolute CD4 T-lymphocyte count falls. Data from prospective controlled trials indicate that fluconazole prophylaxis can reduce the risk for mucosal (*e.g.*, oropharyngeal, esophageal, and vaginal) candidiasis among patients with advanced HIV disease. However, routine primary prophylaxis is not recommended because mucosal disease is associated with very low attributable mortality, acute therapy is highly effective, prophylaxis can lead to disease caused by drug-resistant species, prophylactic agents can produce drug interactions, and prophylaxis is expensive [31]. It is recommended that the HIV-infected asymptomatic cases with $CD4^+$ cell counts ≤ 200 cell/mm^3 should be screened for oral candidiasis to improve the quality of life.

ART has been associated with dramatic decreases in the rate of HIV-related opportunistic infections. Our study suggests that ART does not influence oral CC, but it significantly prevented the development of OPC. In a follow-up study, Yang *et al.* reported that ART was only marginally effective in eliminating colonization [32]. Similarly, Sanchez-Vargas *et al*. reported that ART did not influence colonization. The authors observed that 36.1% of patients undergoing ART suffered from OPC compared to 45.9% of patients not receiving ART [1].

Conclusion

Oral *Candida* colonization and invasive infection occur more frequently in HIV-positive patients and is significantly more common in patients with $CD4^+$ cell counts ≤ 200cell/mm^3.ART significantly reduces OPC. *C. albicans* continues to be the most frequently isolated species in both OPC and CC, suggesting endogenous infection.

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