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Periodontal status of HIV infected patients with special reference to CD4 cell count in West Bengal, India

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ABSTRACT

Objective: To evaluate the periodontal status of HIV seropositive patients and to find out if any correlation exists between the severity of periodontal disease and the CD4 cell count in HIV patients. **Methods:** One hundred and thirty patients attending the Viral Diseases OPD, Calcutta School of Tropical Medicine, Kolkata were examined. They were grouped according to the CD4 cell count as Group A – Subjects with CD4 Cell count < 200/ μ L and Group B – Subjects with CD4 Cell count \geq 200/ μ L. Their community periodontal index of treatment needs (CPITN) score were recorded. **Results:** It was found that most of the patients in each group were having score '2' (*i.e.* presence of supra or subgingival calculus), as their highest score. A statistically significant association was found between immune status as depicted by CD4 cell count and periodontal status as shown by highest CPITN score in the present study. **Conclusions:** The present study confirms the effect of immunosuppression on periodontal diseases in HIV infected patients.

1. Introduction

Acquired immunodeficiency syndrome (AIDS) appears to be a threat to the existence of the mankind, in which the causative organism *i.e.*, human immunodeficiency virus (HIV) targets and jeopardizes the defense mechanism (T lymphocytes) of the host. HIV infection or AIDS has evolved from a mysterious illness to a major global pandemic. AIDS was first recognized in USA in 1981. In 1983 the HIV virus was isolated from a patient with lymphadenopathy and by 1985 a sensitive ELISA had been developed. According to estimates from the UNAIDS (Joint United Nations Programme on HIV/AIDS) 2009 AIDS Epidemic Update, around 31.3 million adults and 2.1 million children were living with HIV at the end of 2008[1].

India reported the first case of AIDS in 1986 and since then the number of patients with HIV infection and full blown

AIDS has been increasing greatly in India and the rest of South and South-east Asia. In 2007, following the first survey of HIV among the general population, UNAIDS and National AIDS Control Organization (NACO) agreed on a new estimate – between 2 million and 3.6 million people living with HIV. The figure was confirmed to be 2.4 million in 2008[2].

The hallmark of HIV disease is a profound immunodeficiency resulting primarily from a progressive quantitative and qualitative deficiency of helper or inducer T cells. CD4 is the surface receptor expressed on T helper lymphocytes. Depletion of CD4 cells is the hallmark of HIV infection. Initial immune suppression is indicated by CD4 levels below 500/mm³ and signals the first appearance of systemic and oral opportunistic infection. CD4 cell count is used to assess HIV disease progression as well as to stage the disease. It is also used to make decision for initiating antiretroviral therapy[3]. More than one third of people who are seropositive for HIV and approximately 90 percent of people with AIDS develop HIV associated oral lesions during the course of the disease[4].

Periodontal changes form an important part of the wide spectrum of oral lesions such as linear gingival erythema,

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necrotizing ulcerative gingivitis and necrotizing ulcerative periodontitis which are characteristic manifestations of this infection. Periodontal manifestations in patients with HIV infection were first described in 1987[5]. At the Fourth International Workshop on Oral Manifestations of HIV Infection, it was emphasized that a greater understanding of the nature and severity of periodontal diseases among people with HIV is necessary in developing countries[6]. Since periodontal status closely reflects the immune status of an individual, its study is important in HIV infection[7]. Though the studies of periodontal manifestations of HIV infection have been done in other parts of the world, such studies are lacking in India especially in the eastern parts of the country. So, the aim of the present study is to evaluate the periodontal status of HIV infected patients in a non dental setup and to find out if any correlation exist between the severity of periodontal disease and CD4 cell count in HIV infected patients.

2. Materials and methods

A sample of 130 HIV infected patients attending the Outpatient Department of Virology, Calcutta School of Tropical Medicine, Kolkata, India were examined for their periodontal status. On the basis of clinical features HIV infected patients were grouped as Clinical stage I, II, III or IV as per WHO clinical staging of HIV/AIDS adults and adolescents, 2006. Periodontal examination of all subjects was done using the Community Periodontal Index of Treatment Needs (CPITN) index, in accordance with the recommendations of WHO[8,9].

CPITN Scoring were as follows:

- SCORE 0: No signs of disease
- SCORE 1: Gingival bleeding after gentle probing
- SCORE 2: Supra- or subgingival calculus
- SCORE 3: Pathologic pockets 4 or 5 mm deep
- SCORE 4: Pathologic pockets 6 mm or deeper

The highest scoring CPITN sextant was recorded for each individual and subjects were then classified according to highest CPITN score as follows:

Subjects without periodontitis—Highest CPITN score ‘0’, ‘1’, or ‘2’.

Subjects with periodontitis—Highest CPITN score ‘3’ or ‘4’.

CD4 cells were estimated based on the principles of fluorescence activated cell sorting (FACS), using MultiSETTM software, to give data on the computer in form of graphs.

On the basis of CD4 cell count, all HIV infected patients were divided into two groups as:

- Group A—Subjects with CD4 Cell count < 200/ μ L
- Group B—Subjects with CD4 Cell count \geq 200/ μ L

The effect of anti retroviral therapy (ART) on periodontal status was also evaluated.

2.1. Statistical analysis

Besides frequency distribution, the data was analysed using *Chi*-square test and Mann–Whitney *U* test. The entire analysis was done using SPSS 11.0 version and Excel 2000.

3. Results

To evaluate the periodontal status of HIV infected patients, a total of 130 subjects were enrolled for the study (Table 1) and CD4 cell count of all the subjects were investigated. The mean age of the patients was 34.20 years.

Table 1
Sex-wise distribution of mean and standard deviation of age of the patients.

Sex	No. of patients	Mean age \pm SD
Male	74	35.58 \pm 7.02
Female	56	32.37 \pm 7.43
Total	130	34.20 \pm 7.35

Table 2
Distribution of highest CPITN Score in HIV seropositive patients [*n* (%)].

Sex	Highest CPITN score				
	0	1	2	3	4
Male	8 (10.8)	10 (13.5)	38 (51.4)	10 (13.5)	8 (10.8)
Female	12 (21.4)	13 (23.2)	22 (39.3)	5 (8.9)	4 (7.2)
Total	20 (15.4)	23 (17.7)	60 (46.2)	15 (11.5)	12 (9.2)

Table 3
Periodontal status of HIV seropositive patients [*n* (%)].

Sex	Non-periodontitis (CPITN Score 0, 1, 2)	Periodontitis (CPITN Score 3, 4)
Male	56 (75.7)	18 (24.3)
Female	47 (83.9)	9 (16.1)
Total	103 (79.2)	27 (20.8)

Chi-square=1.319, *df*=1, *P*>0.05.

Table 4
Sextant wise distribution of CPITN Score in HIV seropositive patients [*n* (%)].

Total no. of patients	Total no. of sextants	Highest CPITN score				
		0	1	2	3	4
130	780	177 (22.69)	214 (27.44)	311 (39.87)	58 (7.44)	20 (2.56)

Table 2 demonstrates the distribution of highest CPITN score among HIV seropositive patients. It was shown that CPITN Score 2 was the most prevalent score (46.2%), where higher percentages of male (51.4%) were affected compared to female (39.3%). Table 3 shows that the CPITN Score 3 or 4, indicative of periodontitis was seen in 20.8 percentage of total HIV seropositive subjects. It was shown that the percentage of subjects with periodontitis (CPITN Scores 3, 4) was higher (24.3%) among male as compared to female (16.1%). However, the distribution was not statistically significant (*P*>0.05). Table 4 reveals that the sextant-wise distribution of CPITN score in HIV seropositive patients, where highest percentage (39.87%) was shown in CPITN

Table 5
Distribution of highest CPITN Score in different WHO groups in HIV seropositive patients [n (%)].

WHO Stages	No. of patients	Highest CPITN Score				
		0	1	2	3	4
Stage I	14	2 (14.3)	3 (21.4)	6 (42.9)	1 (7.1)	2 (14.3)
Stage II	49	10 (20.4)	11 (22.4)	19 (38.8)	4 (8.2)	5 (10.2)
Stage III	46	5 (10.9)	3 (6.5)	28 (60.9)	5 (10.9)	5 (10.9)
Stage IV	21	3 (14.3)	6 (28.6)	7 (33.3)	5 (23.8)	0 (0.0)
Total	130	20 (15.4)	23 (17.7)	60 (46.2)	5 (11.5)	12 (9.2)

score 2. The distribution of patients in each WHO group and distribution of their highest CPITN score is shown in Table 5. It was found that Score 2 was the most prevalent in all WHO stages.

Table 6
Periodontal Status of different WHO groups in HIV seropositive patients [n (%)].

WHO Stage	Non-periodontitis	Periodontitis
Stage I	11 (78.6)	3 (21.4)
Stage II	40 (81.6)	9 (18.4)
Stage III	36 (78.3)	10 (21.7)
Stage IV	16 (76.2)	5 (23.8)
Total	103 (79.2)	27 (20.8)

Table 6 depicts that as the WHO stage advanced,

Table 7
Distribution of Highest CPITN Score in Group A and Group B in HIV seropositive patients [n (%)].

Group	CD4 cell count	No. of patients	Highest CPITN score				
			0	1	2	3	4
Group A	< 200 µL	47	10 (21.30)	8 (17.00)	14 (29.80)	9 (19.10)	6 (12.80)
Group B	≥ 200 µL	83	10 (12.00)	15 (18.10)	46 (55.40)	6 (7.20)	6 (7.20)
Total		130	20 (15.40)	23 (17.70)	60 (46.20)	15 (11.50)	12 (9.20)

Chi-square = 10.644, df=4. P<0.05 compared within Group A and B.

Table 8
Periodontal status of Group A and Group B in HIV seropositive patients [n (%)].

Groups	CD4 cell count	No. of patients	Periodontal status	
			Non-periodontitis (CPITN Score 0, 1, 2)	Periodontitis (CPITN Score 3, 4)
Group A	< 200 µL	47	32 (68.1)	15 (31.9)
Group B	≥ 200 µL	83	71 (85.5)	12 (14.5)
Total		130	103 (79.2)	27 (20.8)

Table 9
Pearson Chi-square value=5.557, df=1, P<0.05 compared within Group A and B. Mann-Whitney U test for HIV seropositive patients.

Periodontal status	CD4 cell count		
	No. of patients	Mean rank	Sum of ranks
Non-periodontitis	103	68.95	7101.50
Periodontitis	27	52.35	1413.50

Mann-Whitney U=1035.500; Wilcoxon W=1413.500; Z=-2.037 Asymp. Sig. (2-tailed)=0.042.

Table 10
Distribution of Highest CPITN Score in different treatment groups in HIV seropositive patients [n (%)].

Category	No. of patients	Highest CPITN Score				
		0	1	2	3	4
On ART	20	3 (15.0)	3 (15.0)	6 (30.0)	5 (25.0)	3 (15.0)
Not on ART	110	17 (15.5)	20 (18.2)	54 (49.1)	10 (9.1)	9 (8.2)
Total	130	20 (15.4)	23 (17.7)	60 (46.2)	15 (11.5)	12 (9.2)

ART = anti retroviral therapy.

Table 9 reveals that there exist a significant (P<0.05) CD4 cell count difference between the subjects with periodontitis

and those without periodontitis in HIV seropositive group based on the Mann-Whitney U test. Table 10 observes the distribution of highest CPITN score in patients on ART and those who were not, where it was revealed that percentage of periodontitis patients (40.0%) was much higher among those on ART as compared to (17.3%) in those not on ART. However, the difference was not significant (P>0.05) (Table 11).

periodontal status worsened, though the distribution was not statistically significant and highest prevalence of periodontitis shown in stage IV WHO group. Table 7 reveals the periodontal status of two groups based on CD4 cell count, score 2 was most prevalent in both the groups– group A (CD4 cell count < 200 µL) and group B (CD4 cell count ≥ 200 µL). Table 8 shows the subjects with periodontitis vs. subjects without periodontitis, as measured by highest CPITN score per sextant in groups A and B. Percentage of subjects with periodontitis (CPITN Scores 3, 4) was higher in Group A (31.90%) as compared to Group B (14.50%). Further, through Chi square test, it was found that the distribution was significant (P<0.05).

Table 11
Periodontal status of different treatment groups in HIV seropositive patients.

Category	No. of patients	Non-periodontitis	Periodontitis
On ART	20	12 (60.0)	8 (40.0)
Not on ART	110	91 (82.7)	19 (17.3)
Total	130	103 (79.2)	27 (20.8)

Parentheses showing percentage; ART = anti retroviral therapy

4. Discussion

Although there have been studies on the effect of immunosuppression on periodontal disease in HIV infected patients, there are very few reports on the association of CD4 cell count with periodontal indices. Moreover, it has not been widely documented in populations from developing countries^[10].

Such studies are scanty in India especially in the eastern part of the country. The present study has been carried out with the purpose to evaluate the periodontal status in terms of CPITN of HIV infected persons and its association with the immunosuppression as expressed by CD4 cell count of the individuals.

To prevent any bias, subjects were taken at random from the Outpatient Department of Virology, Calcutta School of Tropical Medicine, Kolkata. Patients with a history of smoking and diabetes—the classical risk factors for periodontal disease were excluded from this study^[11–13].

Numerous studies have documented the relationship between immunosuppression and periodontitis; however there has been no standard means of periodontal assessment in those studies^[14–19]. In the present study the established CPITN has been used to assess the periodontal status.

In this study, all HIV infected subjects were divided into two groups on the basis of CD4 cell count as Group A ($CD4 < 200/\mu L$) and Group B ($CD4 \geq 200/\mu L$)^[14,18,20].

In the present study, it was found that out of total 130 heterosexual HIV infected subjects, 84.6 percent presented with some form of periodontal disease, this data is similar to another study where 81 percent of the HIV heterosexual subjects presented with periodontal disease in a non-dental setting^[21].

It is of interest to note that none of the patient in the present study presented with linear gingival erythema (LGE), despite its reported prevalence of about 47 percent in India^[10]. In this present study, males were found to be more affected with periodontal disease than females, although this difference was not statistically significant. This observation is in contrast to one of the past study^[21], where women had significantly more severe periodontal disease than men. There are limited studies available showing differences based on gender. A possible explanation for the findings of present study might be the fact that females are more concerned of their oral hygiene maintenance.

Recent review reported the prevalence of necrotizing ulcerative gingivitis (NUG) and necrotizing ulcerative periodontitis (NUP) to be 0%–9% in HIV infected subjects^[22], but in this present study, none of the patient presented with features suggestive of these clinical conditions. When WHO staging, based on clinical presentation of HIV infection was related with periodontal status, it was found that as the stage (WHO) advances, periodontal status worsens, though it was not statistically significant. There are limited studies available for comparison of such observation. A statistically significant association was found between immune status as

depicted by CD4 cell count and periodontal status as shown by highest CPITN score in the present study. Such findings have also been supported by other studies among different populations^[14,15,20,23,24]. In contrast, few studies have not found any significant relationship between CD4 cell count and periodontal status^[18,19,25–28].

The effect of ART on periodontal status was also evaluated in this study and it was found that the percentage of periodontitis patients (40.0%) was much higher among those on ART as compared to (17.3%) those not on ART, which might be because CD4 cell count of all the patients on ART was below $300/\mu L$. There is limited literature for comparison of such an observation, although one study has shown that use of HAART (Highly Active Anti Retroviral Therapy) had no consistent effect on periodontal disease progression^[26].

One limitation of the present study was the relatively small study sample. In order to reach to more reliable conclusions, more patients should be included, especially individuals with CD4 cell counts $< 200/\mu L$.

In addition, despite the general agreement regarding the importance and utility of CPITN, its use has been critically evaluated in a number of studies^[29–41]. It has been claimed that CPITN findings overestimated both the prevalence and severity of periodontal attachment loss among younger age groups but underestimated these parameters in older subjects.

In the present study, it was found that most prevalent CPITN score among HIV infected subjects was score 2 (46.2%) and 20.7 percent of the subjects had periodontitis. The prevalence of periodontitis was significantly greater in patients of the group having $CD4 < 200$ (31.9%) than in the group having $CD4 > 200$ (14.5%). Males were found to be more affected than females. The present study confirms the effect of immunosuppression on periodontal diseases in HIV infected patients. But, it needs to be emphasized that prospective, well controlled randomized studies with larger number of patients in this geographical region are further needed to throw more light on the observations made in this study and to come to a definite conclusion.

Conflict of interest statement

We declare that we have no conflict of interest.

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