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NOTE

Influence of smoking on HIV infection among HIV-infected Japanese men

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Abstract We performed a cross-sectional study that included 100 HIV-infected Japanese men without hemophilia to examine the influence of smoking on HIV infection. History of smoking was obtained using a questionnaire. The percentage of current smokers was 40 % and was the highest (50 %) among men in their forties. The mean Brinkman index (BI, number of cigarettes smoked per day multiplied by years of smoking) was 450. The percentage of patients with a BI $\geq$600 was significantly higher in patients with an AIDS-defining event than in those without an AIDS-defining event. A BI $\geq$600 was associated with an AIDS-defining event. Reducing smoking appears to be critical to enhancing disease management efforts in Japanese men with HIV.

Keywords Smoking · Human immunodeficiency virus (HIV) infection · Brinkman index · AIDS-defining event

Current treatment has significantly decreased the mortality associated with AIDS and prolonged survival of patients infected with human immunodeficiency virus (HIV). Smoking is a well-known risk factor for conditions such as cancer, stroke, heart disease, and chronic obstructive pulmonary disease, and smoking has been independently associated with morbidity and mortality in HIV-infected individuals [1–3]. Recent studies have demonstrated that smoking also is correlated with the stage of HIV [2].

The prevalence of cigarette smoking has been shown to be particularly high in HIV-infected individuals [1, 3, 4], ranging from 40 to 70 % in European and North American HIV cohorts. This smoking rate is two to three times higher than that in corresponding general populations [3–8]. Smoking characteristics in HIV-infected populations probably differ from those in the general population because of factors related to having a chronic life-threatening disease and undergoing treatment for it, related psychological and behavioral factors, and, in some patients, other substance abuse issues [9]. Mortality and morbidity are significantly increased in HIV-infected individuals according to both smoking status and pack-years [10]. However, participants in the studies cited were predominantly derived from one or two ethnic groups. Cigarette smoking among HIV-infected individuals in Japan has not been examined.

This study examines influence of smoking on HIV infection among Japanese men with HIV. To our knowledge, this is the first study about cigarette smoking among Japanese HIV-infected patients.

We determined the history of tobacco smoking by using physician-completed questionnaires with 156 HIV-infected outpatients without hemophilia who were treated at Juntendo University Hospital in Tokyo, Japan between July 2010 and 2011. Patients were eligible if they had evidence of HIV infection in the form of either positive Western blot findings or measurable plasma HIV-1 RNA. A total of 112 HIV-infected patients responded to the questions asked. Seven patients were excluded because antiretroviral therapy had been initiated at another institution and information about their status before treatment was unavailable.

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Two female patients and three non-Japanese patients were excluded. We selected 100 male respondents based on retrospective chart review.

This study was approved by the Research Ethics Committee of Juntendo University School of Medicine, and informed consent was obtained from each patient.

We obtained patient histories to ascertain demographic characteristics, HIV risk factors, and previous HIV-related diagnoses. Patients underwent a baseline physical examination to examine clinical characteristics. We also used a questionnaire to obtain history of tobacco smoking. Each doctor verbally asked about the history of tobacco smoking by use of a questionnaire and filled in the answers personally. All data on smoking in this study were obtained from the patient responses.

Height and weight were measured following a standard procedure and body mass index (BMI) was calculated as weight/height (kg/m^2). Venous blood was drawn from the patients. The most recent laboratory data were obtained from patients who had never received antiretroviral therapy, and just before initiating antiretroviral therapy from those who had, to exclude influences of antiretroviral therapy.

Descriptive statistics are reported as means with standard SD or medians. Smoking status was expressed in the terms of the Brinkman index (BI, number of cigarettes smoked per day multiplied by years of smoking) [11]. Patients with and without an acquired immunodeficiency syndrome (AIDS)-defining event were compared. Demographic and clinical characteristics were compared between these two groups using the unpaired *t* test, Mann–Whitney *U* test, or chi-square test. The level of statistical significance was defined as $P < 0.05$, and all data were analyzed using JMP version 9 (SAS Institute).

A total of 100 Japanese men were included in this analysis. Mean age was 42 ± 13 years, and 29 % (26/90) had an AIDS-defining event. Mean baseline CD4 lymphocyte count was 221 ± 25.1/μl and mean baseline $\log_{10}$ HIV-1 RNA was 4.5 ± 0.7 copies/ml (Table 1). Forty percent (40/100) were current smokers, and mean BI was 450 ± 53. Among our patients, 74 % (59/80) were men who have sex with men (MSM), and 1 % (1/100) had a history of intravenous drug use. A total of 78 % (71/91) of patients received antiretroviral therapy based on guidelines for the use of antiretroviral agents in HIV-1-infected adults and adolescents [12] (Table 1).

The percentage of current smokers was 40 % and was the highest (50 %) among men in their forties (Fig. 1). The percentage of current smokers in our study was 23.1 % in their twenties, 48.6 % in their thirties, 50 % in their forties, 26.7 % in their fifties, and 20 % in their sixties (Fig. 1); that of the general Japanese male population in 2011 was 35.2 % in their twenties, 40.6 % in their thirties, 39.2 % in their forties, 40.9 % in their fifties, and 23.9 % in their sixties [13]. The peak percentage of current smokers was in a younger generation than that in the general Japanese male population. This finding was consistent with previous reports based on other ethnic populations [3–8].

Table 1 Patient characteristics

Factors	*N*	Mean ± SD	Factors	*n*	Number (weighted %)
Age (years)	100	42.1 ± 12.7	HIV treatment history (yes)	91	71 (78.0)
BMI (kg/m^2)	82	21.9 ± 3.4	AIDS-defining event (yes)	90	26 (28.9)
Brinkman index	64	450 ± 53	MSM (yes)	80	59 (73.8)
HIV RNA level (log copies/ml)	88	4.5 ± 0.70	Drug (yes)	100	1 (1.0)
CD4 (cells/nl)	89	221 ± 25.1	Smoker (current/previous)	64	40/24 (40.0/24.0)

Value are mean ± SD and number (weighted %)

BMI body mass index, *MSM* men who have sex with men

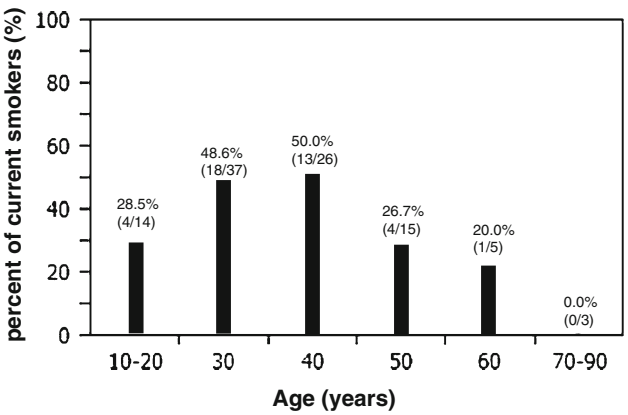

Fig. 1 Percentage of current smokers classified by age

The percentage of patients with a BI ≥600 was significantly higher in patients with AIDS-defining events than those without AIDS-defining events (Table 2). Wojna et al. [2] reported that current smoking was correlated with higher HIV RNA level and history of smoking was correlated with lower CD4 lymphocyte counts. Feldman et al. [14] showed that smokers initially had higher CD4 lymphocyte counts and AIDS-defining events than those who had never smoked.

The cross-sectional study design and small sample size of our study limited our ability to assess causal associations

Table 2 Comparison of patients with and without an AIDS-defining event

Baseline characteristics	*n*	With AIDS-defining event ($n = 17$)	Without AIDS-defining event ($n = 41$)	*P* value
Age (years)	58	47.6 ± 3.08	42.3 ± 1.98	0.1553[a]
BMI (kg/m^2)	52	22.0 ± 1.36	21.6 ± 0.40	0.1743[b]
MSM	40	11 (73.3 %)	29 (82.9 %)	0.4404[c]
CD4 (cells/μl)	57	37.3 ± 11.2	275 + 30.9	<0.0001[b, *]
HIV RNA level (log copies/ml)	56	4.82 ± 0.13	4.43 ± 0.11	0.0638[b]
Brinkman index	64	578 ± 121	357 ± 39.5	0.1179[b]
Brinkman index ≥600	11	6 (35.3%)	5 (12.2 %)	0.0411[c, *]

Value are mean ± SD and number (weighted %)

BMI body mass index, *MSM* men who have sex with men

* $P < 0.05$

[a] Unpaired *t* test

[b] Mann–Whitney *U* test

[c] Chi-square test

of smoking with HIV infection. In addition, the tax rate of cigarettes increased in Japan in October 2010 [15], which may have influenced the percentage of current smokers in our study.

In conclusion, the peak percentage of current smokers was in the younger generation and was higher among HIV-infected patients selected from Japanese men compared to the general Japanese male population. A BI ≥600 was associated with AIDS-defining events in HIV-infected Japanese men. Therefore, smoking cessation is critical to enhancing disease management efforts in HIV-infected patients.

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Conflict of interest None of the authors has conflict of interest with the submission.

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