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Three-Year Incidence Study of Retroviral and Viral Hepatitis Transmission in a Peruvian Prostitute Population

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Summary: A Peruvian female prostitute population was evaluated over a 3-year period to determine the incidence and risk factors of retroviral and viral hepatitis transmission. At three survey periods, a questionnaire was administered and serum samples were obtained. A total of 966 subjects were studied, with 34% followed for 38 months, 22% followed for 18 months, and 44% evaluated just once. On initial evaluation, 3 (0.3%) had HIV-1 antibody, 170 (17.6%) had HTLV-I antibody, 578 (59.8%) had anti-HBc, and 7 (0.7%) had antibody to hepatitis C virus. The mean annual incidence of HTLV-I and hepatitis B infection was 1.6% and 4.7%, respectively. Univariate and logistic regression analysis of prevalence data indicated an association between sexual activity and HTLV-I and hepatitis B infection, but no independent risk factors were identified in cohort analysis. Parenteral risk factors were not associated with transmission, except for a small percentage of subjects who may have acquired hepatitis B infection from blood transfusions. These findings suggest that there is a high incidence of HTLV-I and hepatitis B infection from heterosexual contact in this female prostitute population. **Key Words:** HIV-1—HTLV-I—HTLV-II—Hepatitis B—Hepatitis C—Prostitution.

In Africa, heterosexual transmission of retroviruses is common among female prostitutes (1,2). In the United States and Europe, parenteral drug abuse has been a major route of retroviral transmission among female professional sex workers (3). The incidence and major routes of retroviral transmission in other regions, like South America, are less well understood (4). Previous cross-sectional studies of a Peruvian female prostitute population showed a high prevalence of human T-cell lymphotropic virus type I (HTLV-I) and hepatitis B virus (HBV) infection (5,6). This Peruvian prostitute population has now been followed for 3 years in order to more fully determine the incidence and risk factors of retroviral and viral hepatitis transmission.

METHODS

The study was conducted at the Public Health Clinic which provides biweekly medical care for all registered female prostitutes in Callao, the port city of Lima. Most registered prostitutes work in several designated brothels, providing sexual services mainly for native Peruvian men and less often for foreign sailors. There is a rapid turnover in the clinic population, with women lost to follow-up when they change residence or occupation.

After providing voluntary informed consent, female prostitutes enrolled in the clinic during three survey periods were evaluated: (a) April, 1987, (b) October, 1988, and (c) June, 1990. At the three survey periods a standardized questionnaire was administered which elicited basic demographic data and information about blood transfusions, travel, the number of years of active prostitution, and the number of sexual encounters during

the prior month. For the third survey additional data was obtained about major surgical procedures, medical injections, condom usage, and anal intercourse. A previous diagnosis of genital ulcer disease was also obtained from clinic records. Specific questions about illicit drug use and contraception were not included because parenteral drug abuse is very rare in this population and most women were using oral contraception (7).

A serum sample was obtained from all subjects during the three survey periods and tested by enzyme immunoassay (EIA) for HIV-1 (Genetic Systems, Seattle, WA, U.S.A.) and HTLV-1 (Cambridge Bioscience, Worchester, MA, U.S.A.). All sera repeatedly reactive by EIA were tested by Western blot (DuPont, Wilmington, DE, U.S.A.). HTLV-1 EIA-reactive sera which were positive by Western blot for p24 protein but negative for gp46 were further tested by radioimmunoprecipitation assay (RIPA).

Sera were considered HIV-1 antibody-positive if reactive by Western blot to two or more of the following bands: p24, gp41, or gp120/gp160. Samples were considered HTLV-1 antibody-positive if reactive by Western blot to both p24 and gp46 or reactive to p24 by Western blot and were RIPA positive (8). Although previous polymerase chain reaction (PCR) analysis of 18 HTLV antibody-positive prostitutes indicated that all were infected with HTLV-I (6), further analysis of HTLV-positive sera was performed using two synthetic peptide-based EIA tests to distinguish HTLV-I from HTLV-II infection: SynthEIA HTLV-I/HTLV-II Peptide EIA (United Biomedical, Hauppauge, NY, U.S.A.) and Select-HTLV B-005 (IAF Biochem International, Montreal, Quebec, Canada).

Serum samples were also tested for total antibody to hepatitis B core antigen (anti-HBc) by EIA (Abbott Laboratories) and for antibody to hepatitis C virus (anti-HCV) by EIA and immunoblot assay (Chiron, Emeryville, CA, U.S.A.). Samples were tested for syphilis infection by rapid plasma reagin (RPR) card test and confirmatory fluorescent treponemal antibody (FTA-abs) test.

Mean values were compared using the Student's t-test and proportions were compared using the χ^2 test with Yates' correction or Fisher's exact test. Cox proportional hazards survival analysis was performed using EGRET (SERC Software Division, Seattle, WA, U.S.A.). Multiple logistic regression analysis (SPSS/PC+, Chicago, IL, U.S.A.) was used to evaluate the 602 subjects in the third survey. Significance was set at the 0.05 level.

RESULTS

Study Population

A total of 966 different prostitutes were enrolled during the three survey periods, with 333 (34%) subjects followed for 38 months, 209 (22%) followed for 18 months, and 424 (44%) evaluated just once, providing 1,368 person-years of observation. There were 642 subjects evaluated in the first survey, 557 in the second survey, and 602 in the third survey.

On entry into the study, the mean age of the 966 subjects was 32.3 years (range 18 to 65 years). Most subjects had been born on the coast of Peru and belonged to the mestizo racial/ethnic group (Table

1). At study entry, subjects reported a mean of 6.2 years of active prostitution (median 5.0; range <1 to 36 years) and a mean of 164 sexual contacts during the prior month (median 150; range 0 to 960). There was a significant correlation between the age of subjects and the duration of prostitution (Pearson's $r = 0.6$, $p < 0.001$).

Among the 602 subjects evaluated in the third survey, 7% had received a blood transfusion; 19% had a history of major surgery; 32% reported using condoms with <50% of sexual contacts; 17% reported occasionally engaging in anal intercourse; 18% reported sexual contact with foreign sailors; and, 24% had a history of genital ulcerative lesions. These 602 subjects reported a mean of 7.3 medical injections during the previous year.

Retroviral Analysis

On initial testing of the 966 study subjects, 3 (0.3%) had HIV-1 and 170 (17.6%) HTLV-I antibody. A sufficient quantity of sera was available to test 145 HTLV-positive sera by SynthEIA HTLV-I/II and 90 by Select-HTLV; all sera were positive

TABLE 1. *Prevalence of retroviral and viral hepatitis infection on initial evaluation of 966 female prostitutes in Peru*

| Characteristic | No. (%) | Percent seropositive[a] | | |
		HTLV-1 antibody	Anti-HBc	Anti-HCV
Age (years)				
18–24	155 (16.0)	9.7	38.7	0.6
25–34	471 (48.8)	14.4	57.7	0.6
35–44	260 (26.9)	23.5	68.5	0.8
>44	80 (8.3)	32.5	85.0	1.3
Race/ethnicity				
Mountain Indian	170 (17.6)	32.4	73.5	1.2
Jungle Indian	71 (7.3)	9.9	71.8	0
Mestizo	689 (71.3)	14.5	55.3	0.7
Black	29 (3.0)	24.1	55.2	0
White	7 (0.7)	14.3	71.4	0
Birth location				
Jungle	90 (9.3)	10.0	66.7	0
Mountain	308 (31.9)	26.0	66.2	0.6
Coast	568 (58.8)	14.3	55.3	0.7
Travel				
None	937 (97.0)	18.0	60.6	0.7
Central/South America	24 (2.5)	4.2	29.2	0
U.S.A./Northern Europe	5 (0.5)	0	60.0	0
Blood Transfusion				
No	897 (92.9)	17.8	59.2	0.8
Yes	69 (7.1)	14.5	68.1	0
Syphilis Serology				
FTA-abs negative	818 (84.7)	16.4	57.0	0.6
FTA-abs positive	148 (15.3)	24.3	75.7	1.4

[a] Too few subjects were positive for HIV-1 antibody for meaningful analysis.

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for HTLV-I except one which was positive for HTLV-II antibody.

Univariate analysis indicated that the prevalence of HTLV-I antibody increased with age and was higher in subjects born in the Andean mountains (Table 1). There was a significant association between HTLV-I antibody positivity and positive syphilis serology ($p = 0.03$), and HTLV-I-positive subjects tended to have had more sexual contacts and significantly more years working as a prostitute (Table 2).

Although three subjects were HIV-1 antibody-positive on initial testing, no HIV-1 antibody seroconversions were found during follow-up. In contrast, among 425 initially HTLV-I antibody-negative subjects who were followed, 17 seroconverted. The mean annual incidence of HTLV-I infection was 1.6%. When the subjects who seroconverted were compared with subjects who remained HTLV-I antibody negative, acquisition of infection was not significantly associated with demographic characteristics or transmission risk factors by univariate or Cox proportional hazards analysis.

Evaluation by logistic regression analysis of the 602 subjects in the third survey indicated that HTLV-I seropositivity was independently associated with age, birth in the mountains and on the coast, and anti-HBc positivity (Table 3). A negative association was found between HTLV-I antibody positivity and contact with foreign sailors.

Hepatitis B and C Analysis

When initially tested, 578 (59.8%) subjects had anti-HBc and 7 (0.7%) had anti-HCV by immuno-

TABLE 2. *Mean age, number of sexual contacts during the prior month, and years of exposure as a prostitute by antibody status on initial evaluation of 966 female prostitutes in Peru*

Characteristic (mean)	HTLV-I	Anti-HBc	Anti-HCV
Age (in years)			
Antibody negative	31.6	29.9	32.3
Antibody positive	35.7[a]	34.0[a]	34.0
Number of sexual contacts prior month			
Antibody negative	162	151	164
Antibody positive	174	173[a]	122
Years of exposure as prostitute			
Antibody negative	5.8	4.4	6.2
Antibody positive	8.1[a]	7.4[a]	3.1

Note. There were 170 subjects who had HTLV-I antibody, 578 who had anti-HBc, and seven who had anti-HCV.
[a] $p < 0.01$.

TABLE 3. *Variables independently associated with HTLV-I antibody and anti-HBc in the third cohort of 602 prostitutes by logistic regression analysis with age and race/ethnicity included in all models*

Model, significant independent variables[a]	Odds ratio	95% CI	p value
Model of HTLV-I infection			
Age (by year)	1.05	1.02–1.08	<0.001
Location of birth (referent jungle)			
Coast	3.2	1.1–9.4	0.03
Mountain	3.9	1.3–11.5	0.01
Sexual contact with a sailor	0.3	0.2–0.6	0.01
Anti-HBc seropositive	2.5	1.5–4.1	<0.001
Model of hepatitis B infection[b]			
Age (by year)	1.04	1.01–1.07	0.003
History of a blood transfusion	2.3	1.04–5.0	0.04
Duration of prostitution (by year)	1.08	1.03–1.13	0.003
HTLV-I antibody seropositive	2.4	1.4–4.0	<0.001

[a] Variables not independently associated with the outcome variable in either model include race/ethnicity, travel history, positive syphilis serology, number of sexual contacts during the prior month, medical injections, condom usage, anal intercourse, and genital ulcer disease.
[b] No interaction was found between age and duration of prostitution.

blot assay. Hepatitis B seropositivity was higher in older subjects, the Amerindian population, and subjects who had received a blood transfusion (Table 1). Subjects with more sexual contacts and with more years of active prostitution were significantly more likely to be anti-HBc positive (Table 2). Anti-HBc positivity was also associated with HTLV-I infection and positive syphilis serology ($p < 0.001$, both comparisons).

Among the 184 initially anti-HBc-negative subjects who were followed, 24 seroconverted, for a mean annual incidence of 4.7%. By immunoblot assay, only one subject seroconverted to anti-HCV. When subjects who seroconverted to anti-HBc were compared with subjects who remained anti-HBc negative, no statistically significant associations were found by univariate or by Cox proportional hazards survival analysis.

Among the 602 subjects evaluated during the third survey period, hepatitis B seropositivity was independently associated with age, a prior blood transfusion, the number of years of active prostitution, and HTLV-I seropositivity by logistic regression analysis (Table 3).

DISCUSSION

The findings of this longitudinal study indicate a high incidence of HTLV-I and hepatitis B infection

in this Peruvian female prostitute population. The level of HTLV-I infection in this population is comparable to other high-risk groups in the Western hemisphere and is much higher than in female prostitutes surveyed in other South American countries (3,4,9). Whether this population also has high incidence of HTLV-I-related morbidity is not known, although spastic paraparesis associated with HTLV-I infection has been described in Peru (10). In contrast to Central and South American Native Indian populations which have been found to have a high prevalence of HTLV-II antibody, this group of prostitutes was primarily at risk of HTLV-I infection (11,12).

Heterosexual transmission appeared to be the primary route of infection for both HTLV-I and HBV in this prostitute population because of the higher risk of infection among subjects who had worked as a prostitute for a longer period of time, had more sexual contacts, and had positive syphilis serology. Parenteral exposure was not associated with infection except in a small percentage of subjects who may have acquired HBV infection from a blood transfusion. The fact that anal intercourse was infrequently reported suggests that HTLV-I and hepatitis B infection were primarily acquired by penile-vaginal contact.

There was no evidence that the increased risk of HTLV-I infection was due to contact with visitors from outside of Peru since sexual contact with sailors was negatively associated with HTLV-I seropositivity by multivariate analysis. This negative association could have resulted from greater use of condoms by sailors (as anecdotally reported by prostitutes after this study was completed) or a higher level of HTLV-I infection in native Peruvians compared with foreign sailors, who were usually from other Latin American countries. The prevalence of HTLV-I infection in the general Peruvian population is not well understood but may be relatively high in some groups (6,13).

The data indicated a relation between the transmission of HTLV-I and HBV, although both the incidence and prevalence of hepatitis B infection was approximately three times greater than that of HTLV-I. Other studies have demonstrated that HBV is transmitted more readily than either HTLV or HIV but that these pathogens share similar modes of transmission (3,14-16).

In contrast to HTLV-I and hepatitis B, there was a very low risk of HIV-1 and hepatitis C infection. As reported previously, female prostitutes without

parenteral risk factors are not at greatly increased risk of hepatitis C infection (17,18), probably because hepatitis C virus is not readily transmitted by heterosexual contact (19,20).

Although prostitutes had a high incidence of HTLV-I and hepatitis B infection, prospective analysis failed to identify independent risk factors of infection. This may have resulted from the small number of subjects who could be followed. Bias from differential loss of subjects during follow-up is also possible, but there was no preferential turnover in the clinic population among different demographic groups and among subjects positive for HTLV-I antibody, anti-HBc, or syphilis serology.

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