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**Transmission of HIV Possibly Associated with Exposure of Mucous Membrane to Contaminated Blood**

In February 1996, transmission of human immunodeficiency virus (HIV) by an unknown route involving an HIV-infected man and his previously uninfected female sex partner was reported to CDC. This report summarizes the epidemiologic investigation of this transmission, which suggests that the woman was infected through mucous membrane exposure to contaminated blood.\*

In 1992, after obtaining informed consent from the HIV-infected man and his uninfected female sex partner, they were enrolled in a study in which couples with one HIV-infected partner and one non-HIV-infected partner were extensively counseled, administered questionnaires, and tested periodically for HIV infection. Blood drawn from the woman on July 19, 1994, was HIV-negative by both enzyme immunoassay (EIA) and polymerase chain reaction (PCR). However, serum specimens obtained from the woman on July 24, 1995, and September 11, 1995, were positive by both EIA and immunofluorescent assay. During the interval from the month before her last HIV-negative test (June 1994) to the month of her first HIV-positive test (July 1995), the woman denied known risk exposures for HIV (i.e., other sex partners; noninjecting- or injecting-drug use; sexually transmitted diseases; blood transfusion; artificial insemination; occupational exposure to HIV; or acupuncture, tattoos, body piercing, or other percutaneous injections).

The sources of information obtained separately from each partner by two independent interviewers during this investigation and by interview records obtained during the study before the couple was aware of the HIV transmission were consistent about the couple's sex practices during June 1994-July 1995. During this period, the woman and her partner reported having vaginal intercourse an average of six times per month but never during menses. The

couple reported always using latex condoms (for men) during sex, most times with the spermicide nonoxynol-9. The couple denied having had anal sex during this period. Although the couple reported a condom breakage that occurred in January 1994, both independently denied awareness of condom breakage or slippage during June 1994-July 1995 and believed that the condom remained in place each time while the penis was withdrawn. The couple engaged in "deep kissing" (open-mouth to open-mouth) several times per month. The man indicated that his gums frequently bled after he brushed and flossed his teeth and that the couple generally engaged in sexual intercourse and "deep kissing" at night after he brushed his teeth. Occasional instances of oral sex between the couple reportedly did not involve the exchange of semen or blood. In addition, the woman recalled using the man's toothbrush and razor, both without visible blood, on one occasion each, but she was unable to specify whether these events occurred during the putative infection period of June 1994-July 1995.

The man had been HIV-infected since 1988 as the result of injecting-drug use, and he reported longstanding poor dentition and occasional sores in his mouth. On August 29, 1994, the man had a normal platelet count and a CD4+ T-lymphocyte count of 110 cells/uL. On September 6, 1994, he sought medical care at a clinic because of a cough, stress, and intermittent weight loss; small vesicles were noted in his throat. At a follow-up visit in April 1995, canker sores, halitosis, and gingivitis were noted. In May 1995, at his first dental visit since 1988, gingivitis and oral hairy leukoplakia were diagnosed. The man had never received antiretroviral medications or prophylaxis against *Pneumocystis carinii* pneumonia although they had been recommended to him.

Because of a 4-month history of increasing dental sensitivity to hot and cold, on August 8, 1994, the woman underwent a dental evaluation followed by endodontic therapy (a "root canal"). Her dental records noted poor condition of gums, 2-mm to 6-mm pockets (indicating periodontitis), poor personal dental hygiene practices, and a recommendation for periodontal therapy. No complications or excessive bleeding from the endodontic therapy were reported by the woman or noted by the dentist. The dentist had been tested for HIV in May 1996 and was negative by EIA.

On August 26, 1994, the woman had onset of a syndrome of 7-10 days' duration characterized by fever of 102 F (39 C), headache, swollen lymph nodes, sore neck and back, and muscle aches in her legs. On September 2, she sought medical care from her primary-care physician, who noted erythema and inflammation of the gingiva. The physician diagnosed a viral process with concomitant gum infection and prescribed erythromycin for treatment. The woman reported no other clinically important illness from June 1994 to July 1995.

Blood samples were obtained from both HIV-infected partners in April 1996. A nested PCR was used to amplify proviral HIV DNA sequences from peripheral blood mononuclear cells (PBMCs), and viral RNA sequences from serum were amplified using a nested reverse transcriptase PCR. Analysis of a 345-nucleotide segment of the C2V3 region of the env gene revealed a 4% nucleotide difference between the man and woman's PBMC proviral sequences and a 9% difference between the viral strains in the man and woman's serum. Sequence analysis of the complete p17 region of the gag gene from the PBMC proviral DNA from each partner indicated only a 1.6% nucleotide difference between the proviral sequences of the man and woman. Phylogenetic analysis of the C2V3 sequences grouped all HIV strains from the couple's PBMCs and serum as a monophyletic clade distinct from sequences from other HIV-infected persons in the United States, with a bootstrap support of 87% (1). These laboratory results indicate a high degree of relatedness between the viruses infecting the man and woman, supporting the conclusion that HIV was transmitted from one to the other. Testing of stored PBMCs obtained from each partner in 1995 produced similar results.

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#### **Editorial Note:**

The findings in this report suggest that the woman probably became infected with HIV during June 1994-July 1995, possibly during the weeks before the onset of her symptoms on August 26, 1994; these symptoms were consistent with acute retroviral syndrome (2). In addition, during June 1994-July 1995, the man's CD4+ T-lymphocyte count was low, which may be associated with increased infectivity and risk for transmission (3). Results of the DNA sequencing and phylogenetic analysis support the epidemiologic findings that the woman's infection was acquired from her infected male partner.

Although the exact route of transmission in this report cannot be determined, the most likely possibility is that the woman became infected through mucous membrane exposure to the man's saliva that was contaminated by blood from his bleeding gums or exudate from undetected oral lesions. Such exposure may have occurred during "deep kissing"; the woman's inflamed gingival mucosa, as indicated by her dental and medical records, might have been a contributing factor. Exposure to saliva uncontaminated with blood is considered to be a rare mode of HIV transmission for at least five reasons: 1) saliva inhibits HIV-1 infectivity (4); 2) HIV is infrequently isolated from saliva (5); 3) none of the approximately 500,000 cases of AIDS reported to CDC have been attributed to exposure to saliva; 4) levels of HIV are low in the saliva of HIV-infected persons, even in the presence of periodontal disease (6); and 5) transmission of HIV in association with kissing has not been documented in studies of nonsexual household contacts of HIV-infected persons (7). However, rare bite-related instances of HIV transmission from exposure to saliva contaminated with HIV-infected blood have been reported (8,9).

Other exposures of the woman to the man's blood or semen cannot be excluded. Although occasional instances of oral sex did not reportedly involve the exchange of semen or blood between the persons in this report, these routes of transmission cannot definitively be excluded. Sexual exposure through vaginal intercourse is a plausible mechanism of transmission for the case described in this report; however, other studies of couples in which one partner is HIV-infected and the other is not indicate

that HIV transmission is rare when heterosexual couples use condoms consistently during vaginal intercourse (10). If a condom is not used correctly, it may slip off or break, thereby reducing its effectiveness as a barrier to HIV. However, for this case, both partners could not recall any instances of condom slippage or breakage during the time infection was likely to have occurred. In addition, although the shared use of a toothbrush or razor are theoretically plausible routes of transmission, the woman recalled that each event occurred only once, and she could not specify whether either event occurred during the period when transmission most likely occurred.

The findings of this investigation underscore the multiple routes by which exposure to infectious body fluids can occur among sexually intimate persons. Uninfected persons considering intimate relationships with persons known to be infected with HIV should be educated about the rare possibility of HIV transmission through mucous membrane exposures. Persons choosing to have sex with HIV-infected persons or persons with unknown HIV serostatus should correctly use latex condoms (for men) during each act of intercourse and should avoid any other exposure to potentially infectious body fluids, including blood, semen, or any other body fluid visibly contaminated with blood.

## References

1. Robbins KE, Bandea CI, Levin A, et al. Genetic variability of human immunodeficiency virus type 1 in rural northwest Tanzania. *AIDS Res Human Retroviruses* 1996;12:1389-91.
2. Schacker T, Collier AC, Hughes J, Shea T, Corey L. Clinical and epidemiologic features of primary HIV infection. *Ann Intern Med* 1996;125:257-64.
3. Laga M, Taelman H, Van der Stuyft P, Bonneux L, Vercauteren G, Piot P. Advanced immuno-deficiency as a risk factor for heterosexual transmission of HIV. *AIDS* 1989;3:361-6.
4. Yeh CK, Handelman B, Fox PC, Baum BJ. Further studies of salivary inhibition of HIV-1 infectivity. *J Acquir Immune Defic Syndr* 1992;5:898-903.
5. Ho DD, Byington RE, Schooley RT, Flynn T, Rota TR, Hirsch MS. Infrequency of isolation of HTLV-III virus from saliva in AIDS. *N Engl J Med* 1985;313:1606.
6. Yeung SC, Kazazi F, Randle CG, et al. Patients infected with human immunodeficiency virus type 1 have low levels of virus in saliva even in the presence of periodontal disease. *J Infect Dis* 1993;167:803-9.
7. Rogers MF, White CR, Sanders R, et al. Lack of transmission of human immunodeficiency virus from infected children to their household contacts. *Pediatrics* 1990;85:210-4.
8. Vidmar L, Poljak M, Tomazic J, Seme K, Klavs I. Transmission of HIV-1 by human bite. *Lancet* 1996;347:1762-3.
9. Anonymous. Notes and news: transmission of HIV by human bite. *Lancet* 1987;2:522.
10. Saracco A, Musicco M, Nicolosi A, et al. Man-to-woman sexual transmission of HIV: longitudinal study of 343 steady partners of infected men. *J Acquir Immune Defic Syndr* 1993; 6:497-502.

\* Single copies of this report will be available until July 11, 1998, from the CDC National AIDS Clearinghouse, P.O. Box 6003, Rockville, MD 20849-6003; telephone (800) 458-5231 or (301) 217-0023.