

RETROVIRUS-LIKE PARTICLES IN  
SALIVARY GLANDS, PROSTATE AND TESTES OF AIDS PATIENTS

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AIDS associated retrovirus-like particles were identified in the salivary gland, prostate and/or testicle of two AIDS patients. These findings further suggest that saliva and semen may transmit the infection to susceptible individuals. © 1985 Society for Experimental Biology and Medicine.

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The acquired immunodeficiency syndrome (AIDS) has been shown to be associated with two similar retroviruses, HTLV-III and lymphadenopathy associated virus (LAV), isolated from peripheral blood lymphocytes (1,2). Epidemiological studies have suggested that the virus can be transmitted by blood or blood products. This is based on investigations of individuals with AIDS who have received blood, intravenous drug users and patients with hemophilia. The route by which other patients become infected remains speculative. Homosexual and bisexual patients have been thought to transmit the agent by sexual intercourse although it is not clear what specific practice is associated with the highest risk (3). Intrauterine or transplacental infection remain possible routes by which infant AIDS patients might be exposed to the virus. A small number of patients have no known risk factors which might explain their developing AIDS. These patients have not been family members, co-workers, social contacts, or health care providers of AIDS patients. This suggests that the disease is not highly transmissible by contact other than sexual practice or blood and blood product exposure.

We report here electron microscopic evidence of retrovirus-like particles with

bar shaped cores in salivary and prostate glands as well as testicles from AIDS patients. The morphology of these particles is consistent with those of the HTLV-III and LAV viruses (4,5). The findings are in agreement with the recent reports of the isolation of HTLV-III from saliva and semen of homosexual men, patients with AIDS-related complex and individuals with AIDS (4-6). The presence of these viral particles in these specimens suggests that saliva and semen may be vehicles for transmission to a susceptible host.

#### Case Reports

Case No. 1: A 38 year old black male homosexual presented with diarrhea, malabsorption and weight loss in December 1982. His gastrointestinal syndrome continued during the ensuing one and one-half years. In the interim, he experienced recurrent *Candida* esophagitis, cutaneous and pulmonary Kaposi's sarcoma, *Pneumocystis carinii* pneumonia, and cytomegalovirus viremia. In May 1984 he developed progressive respiratory distress with bilateral pulmonary infiltrates and died. Autopsy demonstrated residual Kaposi's sarcoma and disseminated cytomegalovirus and *M. avium-intracellulare* infections; a severe

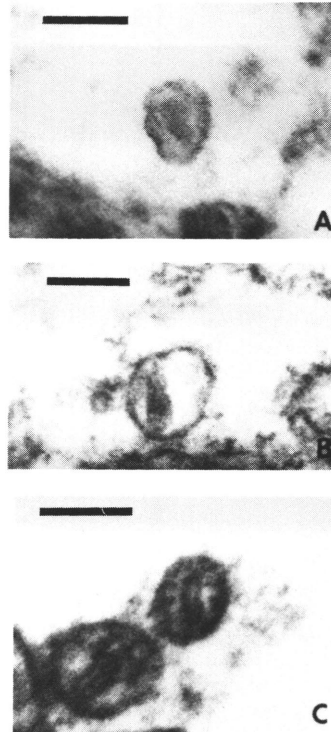
ulcerative cytomegalovirus colitis was present. No herpesvirus-like particles were seen in tissues examined by electron microscopy.

Case No. 2: A 31 year old white male homosexual had been in good health until March 1984 when he presented with Pneumocystis carinii pneumonia (PCP). The PCP resolved following trimethoprim-sulfamethoxazole and pentamidine therapy. However, in April 1984 the patient developed a fever of unknown origin which would persist for the ensuing final two months of his life. During May 1984, he experienced tender hepatomegaly, headaches and blurred vision. Liver function tests showed progressive deterioration. In June 1984 he developed pancytopenia. He became tachypneic as bilateral pulmonary infiltrates appeared. On June 11 intracytoplasmic yeast-like organisms were seen within leukocytes on a peripheral blood smear which was consistent with a disseminated histoplasmosis infection. Amphotericin B therapy was initiated. Nevertheless, progressive respiratory and renal insufficiency followed and he expired on June 13, 1984.

At autopsy, histopathologic examination demonstrated an overwhelming disseminated histoplasmosis infection. Histoplasma capsulatum was cultured from bone marrow, lungs, liver, spleen, adrenal glands and brain.

Electron Microscopy Findings: Tissues taken at postmortem were fixed in 5% glutaraldehyde in phosphate buffered saline, post fixed in 1% Osmium tetroxide in cacodylate buffer, dehydrated in ethanol, cleared in propylene oxide, embedded in Araldite 502 and cured overnight at 70°C. Thin sections were double stained in uranyl acetate and lead citrate and examined in a JEM 100 CX II electron microscope at an instrumental magnification of 36,000x.

Figure A shows a virus-like particle with a bar shaped core in the salivary gland from patient 1. Figure B shows a similar particle in the prostate gland taken from patient 2. In Figure C, 2 similar retrovirus-like particles can be seen in testicular tissue from the same patient. (Final magnification in all figures, 100,000x). Spherical, virus-like particles were also detected in salivary glands and testes of both patients and in prostate gland of patient 2. Virus-like particles were not found in abundance.



**Legend to Figure. Retrovirus-like particle in tissues from AIDS patients.**

Spherical, virus particles with elongated cores in thin sections of salivary gland (A, patient 1), prostate (B, patient 2), and testicle (C, patient 2). Magnification in all figures, 100,000x. Bar in all figures equals 100 nm.

The morphological characteristics of AIDS retrovirus include size (approximately 140 nm), shape (round with a double membrane) and an elongated core which can be seen in transverse sections of the cylindrical core. The size, shape and presence of an elongated core were used as morphological characteristics of AIDS retrovirus. The particles we found (Figure A,B,C,) meet these criteria and resemble those published in electron micrographs of HTLV-III and LAV particles as well as our own observations of HTLV-III (1,2,7,8 and unpublished). All particles were detected in intercellular spaces. Since spherical cores are a general characteristic of most virus particles in thin section, we considered an elongated core to be

essential for identification of AIDS like viruses.

**Discussion:** The presence of AIDS associated retrovirus-like particles in salivary gland, prostate and/or testicle of two AIDS patients suggest that saliva and semen may be body fluids by which transmission could occur to susceptible individuals. Recent reports have also shown that the HTLV-III virus can be isolated from the saliva and semen of homosexual men, individuals with AIDS-related complex and patients with AIDS (4-6). Virus isolation was not attempted in these studies.

A report by Chandler et al. found unidentified virus-like particles, which did not have the appearance of retroviruses, in the intestine of AIDS patients (9). Unlike our studies, these investigators failed to find virus in salivary gland, prostate or testis. There appear to be no differences between our patients and those reported by Chandler. One possible explanation for our success may be that our autopsies were performed shortly after death and the tissues were then immediately processed for electron microscopy. These rapid procedures may have preserved the morphology of the retrovirus-like particles in these specimens, although some distortion would be expected, including loss of double membrane resolution of the viral coat. The recent report by Groopman et al. (4), in which virus particles were demonstrated, was based on biopsy material, not postmortem specimens. We wish to thank Michael C. Pistole, M.D., for referring patient 1.

#### References

1. Gallo RC, Salahuddin SD, Popovic M, et al. Frequent detection and isolation of cytopathic retroviruses (HTLV-III) from patients with AIDS and at risk for AIDS. *Science* 224:500-503, 1984.
2. Barre'-Sinoussi F., Chermann TC, Rey F, et al. Isolation of a T-lymphotropic retrovirus from a patient at risk for acquired immune deficiency syndrome (AIDS). *Science* 220:868-871, 1983.
3. Guinaw ME, Thomas PA, Pinsky PF, et al. Heterosexual and homosexual patients with the acquired immunodeficiency syndrome. *Ann Int Med* 100:213-218, 1984.
4. Groopman JE, Salahuddin SZ, Sarngadharan MG, et al. HTLV-III in saliva of people with AIDS-related complex and healthy homosexual men at risk for AIDS. *Science* 226:447-448, 1984.
5. Zagury D, Bernard J, Leibowitch J, et al. HTLV-III in cells cultured from semen of two patients with AIDS. *Science* 226:449-451, 1984.
6. Ho DD, Schooley RT, Kaplan JC, et al. HTLV-III in the semen and blood of a healthy homosexual man. *Science* 226:451-453, 1984.
7. Vilmer E, Barre'-Sinoussi F, Rouzioux C, et al. Isolation of new lymphotropic retrovirus from two siblings with haemophilia B, one with AIDS. *Lancet* i:753-757, 1984.
8. Schubach J, Popovic M, Gilden RV, et al. Serological analysis of a subgroup of human T-lymphotropic retroviruses (HTLV-III) associated with AIDS. *Science* 224:503-505, 1984.
9. Chandler FW, White EH, Callaway CS, et al. Unidentified virus-like particles in the intestine of patients with the acquired immunodeficiency syndrome. *Ann Int Med* 100:851-853, 1984.

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