Human T-Cell Lymphotropic Virus Type III (HTLV-III) Infection: How It Can Affect You, Your Patients, and Your Anesthesia Practice

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REVIEW ARTICLE

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Summary

This review will define human T-cell lymphotropic virus type III (HTLV-III) carrier states, including acquired immunodeficiency syndrome (AIDS), outline their clinical and epidemiologic patterns, discuss the virus’s unique effects on the host immune system, and comment on current efforts to find a cure for patients with HTLV-III infection. We will discuss the risk of HTLV-III transmission within the hospital environment to medical personnel and patients and reasonable procedures that anesthesiologists can use to prevent transmission of HTLV-III infection.

Why Our Concern for HTLV-III Infection?

In 1981, reports from the Centers for Disease Control (CDC) and elsewhere described previously healthy homosexual men in New York and California with an unexplained deficiency of the immune system.1-3 This deficiency was manifested by the presence of Pneumocystis carinii pneumonia and Kaposi’s sarcoma. The medical and lay communities have since come to recognize these illnesses as being manifestations of AIDS, the lethal disease complex associated with HTLV-III infection. We now realize that HTLV-III infection has progressed from a medical curiosity seen only in small numbers and well-defined risk populations to a major public health problem. As of November 10, 1986, 27,519 AIDS cases had been reported to the CDC. In addition, there are estimated to be hundreds of thousands of asymptomatic carriers of HTLV-III.4,5 These carriers may constitute an unrecognized threat of infection to others.

Anesthesiologists will care for patients with AIDS or carriers of HTLV-III. A legitimate concern to anesthesiologists is the personal risk of caring for these patients. HTLV-III has been reported to be present in many of the body fluids that we frequently contact.6 Furthermore, there is a theoretical risk of exposure for subsequent patients who are anesthetized in the same operating room with the same apparatus as, for example, an asymptomatic carrier of HTLV-III. Many questions arise. Does the virus survive in the environment of an anesthetic machine or on a table top? What measures should be used while caring for a patient with recognized HTLV-III infection? Are anesthesiologists at risk for acquiring HTLV-III infection from their patients?

Definition of HTLV-III Infection

HTLV-III infection encompasses a wide variety of presentations, ranging from totally asymptomatic carriers to
patients with AIDS. Intermediate to these two groups are patients with symptoms that do not meet the stringent CDC guidelines for diagnosing AIDS. The number of individuals with AIDS reflects only a small percentage of the total number who are infected with HTLV-III.

The initial CDC case definition for AIDS as reported in September 1982 remains a logical point to begin to understand HTLV-III infection. At that time, the definition was based solely on clinical observation because the etiology of AIDS was unknown. It was defined as the occurrence of either a life-threatening opportunistic infection, such as P. carinii pneumonia, or the development of Kaposi’s sarcoma in a person younger than 60 years old without underlying immunosuppressive disease and not receiving immunosuppressive therapy.

Since then, HTLV-III has been recognized as the cause of AIDS. The clinical symptoms associated with HTLV-III infection may be directly due to this virus or the result of the immune dysfunction it causes. The recognition of HTLV-III as the etiologic factor in AIDS has resulted in recent updates of the CDC definition of AIDS for purposes of national reporting. This definition continues to include only the more severe aspects of HTLV-III infection, but has been made more explicit with the ability to test for HTLV-III antibody. It also specifies the particular diseases that may be used as indicators of an underlying acquired immunodeficiency. For example, if a patient has a positive serologic or virologic test for HTLV-III, non-Hodgkin lymphoma of high-grade pathologic type may warrant inclusion in the definition for AIDS in the absence of opportunistic diseases.

The classification of disease manifestations of HTLV-III infection other than AIDS is less well defined and a potential source of confusion. Various terms have been used to describe high-risk persons with AIDS-related but nonspecific symptoms. For example, chronic lymphadenopathy syndrome in homosexual men and pre-AIDS are names that have been used to describe this group. The term pre-AIDS is inappropriate because it is not known what percentage of this group will actually develop AIDS. The terms AIDS-related complex (ARC) and HTLV-III-related disease also have been used to describe individuals with conditions that are clearly AIDS-related but not fitting the surveillance definition for AIDS. Other classifications have been recently proposed. For simplicity, we will use the term ARC in this review.

The largest and most elusive group of those infected with HTLV-III consists of asymptomatic carriers. Because HTLV-III isolation techniques are insensitive and not readily available, a positive antibody to HTLV-III is used as an indicator of prior exposure. For public health purposes, the CDC considers patients both infected and infective if they have repeatedly reactive screening tests for HTLV-III antibody (e.g., enzyme-linked immunosorbant assay [ELISA]) in addition to a positive supplemental test (e.g., Western blot [WB], immunofluorescence assay).

The antibody to HTLV-III is quite common in people in defined risk groups such as homosexual men or intravenous drug abusers. Studies of asymptomatic homosexual men document a prevalence of antibody to HTLV-III of greater than 50% in some groups. In one report, 87% of a high-risk group of asymptomatic, heavy intravenous drug users in New York City were antibody positive. Surveys of asymptomatic hemophiliacs using factor concentrates indicate 39–85% are HTLV-III antibody positive. These numbers vary with the amount of factor used, type, and mode of factor preparation.

**Clinical Characteristics of the HTLV-III Disease Spectrum**

The natural history of HTLV-III infection is difficult to elucidate because many people are exposed but unaware of the acquired infection. Within 6 to 13 days of exposure, some individuals may develop an illness resembling acute infectious mononucleosis with symptoms of sore throat, headache, fever, nausea, myalgias, macular rash, malaise, pyrexia, lymphadenopathy, and diarrhea persisting for as long as 2 weeks. Serocconversion to HTLV-III antibody positivity usually occurs within 3–12 weeks of exposure.

Most infected persons are initially asymptomatic. In those who progress to AIDS, the asymptomatic period from time of seroconversion to presentation with AIDS may be 6 years or greater. With disease progression, a constellation of signs and symptoms may occur and include generalized lymphadenopathy, weight loss, chronic diarrhea, malaise and lethargy, lymphopenia, idiopathic thrombocytopenia, leukopenia, anemia, immunodeficiencies, and oral candidiasis.

AIDS is characterized by these symptoms plus marked immunologic abnormalities, opportunistic infections, unusual malignancies, and central nervous system dysfunction. These major clinical characteristics associated with AIDS will be discussed in more detail.

**Immunologic Abnormalities**

Immunologic abnormalities are common in patients with HTLV-III infection. In patients with AIDS, the immune system becomes devastated following selective infection of T4 lymphocytes (also known as helper/inducer T-cells) by HTLV-III. The T4 lymphocyte population plays a central role in control of the immune system by inducing natural killer cells and elaborating a variety of growth and differentiation factors directed at other lym-
phoid cells. Infected cells fail to stimulate appropriate immune responses. Functional defects develop in virtually all aspects of the immune system. These include decreased delayed hypersensitivity reactions, decreased lymphocyte blast transformation by mitogens and antigens, B-cell activation with hypergammaglobulinemia, decreased macrophage chemotaxis, lymphopenia, and enhanced levels of alpha interferon as well as others.10,50,53-55 The helper (T4) to suppressor (T8) lymphocyte ratio (T4/T8) is consistently low in patients with AIDS or ARC.

**OPPORTUNISTIC INFECTIONS**

The presence of impaired immune defenses in patients with AIDS allows common environmental pathogens to prosper. *P. carinii* is the most common opportunistic infection found in AIDS patients and is diagnosed once or more in 60–90% of adult AIDS patients.10,56-58 Each *P. carinii* infection is associated with a 30–50% mortality rate.59 Other organisms that take advantage of the dysfunction of the immune system include other viruses, bacteria, fungi, and protozoans. Herpes virus is a frequent and often fatal opportunist in patients with AIDS.60 Tuberculosis and atypical mycobacterial infections are found in as many as 20% of these patients.36,58 Oral candidiasis is ubiquitous in this population.

**MALIGNANCIES**

Patients with AIDS have an increased risk of developing a number of unusual malignancies. Although these can be disseminated and aggressive, they are less likely than opportunistic infections to lead to the death of these patients.58,61 Kaposi’s sarcoma is the most common malignancy associated with AIDS infection. Prior to 1980, Kaposi’s sarcoma was a rare malignancy in the United States that was seen primarily in elderly men of Eastern European descent.42 Worldwide, it was most prevalent in Zaire, Africa.43 In addition, it has been reported to develop in immuno suppressed patients.45 Prior to the recognition of AIDS, the New York University Coordinated Cancer Registry for Kaposi’s Sarcoma listed only three cases in men under 50 years of age from 1961–1979.1 Currently, as many as 35% of all AIDS patients in San Francisco have this cancer.44 Kaposi’s sarcoma is distinguished by multiple, vascular nodules on the skin and organs, including the gastrointestinal tract, lung, liver, and lymph nodes.38

Other malignancies associated with AIDS include squamous cell carcinoma of the mouth and rectum and aggressive lymphoreticular malignancies.45 The squamous cell cancers are also linked to infection with herpes simplex virus type II, another common infection in patients with HTLV-III infections.46

**CENTRAL NERVOUS SYSTEM DYSFUNCTION**

Early in the elucidation of the clinical characteristics of AIDS, one of the most puzzling findings was the high frequency of central nervous system dysfunction manifested as dementia, encephalopathy, and myelopathy. These manifestations appear to be progressive and untreatable.56,58-60 The myelopathy is frequently associated with paraparesis, spasticity, and ataxia.49 HTLV-III may be a neurotropic virus that directly infects the brain and spinal cord tissues or it may be present in infected lymphocytes in these tissues.49,54

The presence of HTLV-III in brain tissue suggests that the virus itself could be the cause of the frequently observed neurologic manifestations.55 HTLV-III has been isolated from cerebrospinal fluid (CSF) and brain tissue and has been strongly implicated in aseptic meningitis. In addition, opportunistic infections secondary to impaired immunologic defenses may, in part, produce these neurologic findings. Brain abscesses secondary to *Toxoplasma gondii* occur in 12.5% of these patients who have neurologic manifestations.55 Meningitis due to *Cryptococcus neoformans* occurs 7.5–10% of the time.36,58 Herpes virus infection has also been identified.

Patients with AIDS may also present with primary CNS lymphomas.58,59,60 These cancers are associated with other immunodeficiency states. In fact, lymphomas of undifferentiated cell type have recently been accepted as diagnostic of AIDS, when accompanied by a positive antibody test for HTLV-III.8

The aforementioned opportunistic infections and malignancies in patients with AIDS are difficult to treat and tend to recur when treated pharmacologically. Once a patient develops an infectious or neoplastic process associated with the clinical definition of AIDS, the length and quality of life is markedly diminished.

**HTLV-III Isolation and Detection**

When AIDS was first recognized clinically, the etiology was unknown. A virus seemed to be the likely cause because of the pattern of transmission by contaminated needles, blood products, and sexual exposure. In 1983, a virus was isolated from the blood of a patient at risk for AIDS and was named the lymphadenopathy-associated virus (LAV).34 In 1984, HTLV-III was isolated and causally linked to AIDS.35 It now appears that these and other T-cell-tropic viruses isolated from patients with AIDS and ARC are different isolates of the same virus.10,56 LAV and HTLV-III have a high degree of correlation at the nucleic acid level. The name HTLV-III is used in this review.

Although similar, the genomes of different HTLV-III isolates may demonstrate sequence variation.56,57 It is
possible, therefore, that one infected individual may harbor multiple forms of the virus. Such variations raise concern that there may be envelope antigenic differences so diverse that a single vaccine might not protect against all variants.

HTLV-III is a human retrovirus. As such, it has ribonucleic acid (RNA) as its genetic material. During a life cycle, the enzyme reverse transcriptase acts on viral RNA to form a single-stranded deoxyribonucleic acid (DNA). This new DNA is, in essence, copied to form a complete double-stranded DNA of the virus’s genome. The viral DNA genome is then integrated with the host cell’s DNA, where it is subsequently transcribed into messenger RNA. Messenger RNA can then be translated into a viral protein.58,59 This process enables the virus to use the host cell to make the proteins necessary for viral replication.

There is a high degree of correlation between previous exposure to HTLV-III and the development of infection as evidenced by the presence of serum antibodies to viral proteins in 90–100% of patients with AIDS and ARC and in more than 50% of certain groups at risk for infection with HTLV-III.60,61 Of interest, in most infected individuals the antibody neither neutralizes the virus nor provides immunity. In addition, HTLV-III can often be detected and isolated from patients with AIDS and ARC.58

Antibody to HTLV-III is usually detected in blood by two methods: 1) an ELISA of antibody to disrupted whole virus that has been grown in human leukemic cell line, H9; and 2) an assay of antibody to specific major viral antigens by the WB technique.4 There are other methods used to detect the presence of HTLV-III, but these are not yet approved by the Food and Drug Administration (FDA). For example, an immunofluorescence assay technique has been used successfully, but is presently limited to research.62 Future tests may use HTLV-III viral proteins obtained from bacterial genetic engineering instead of virus grown in human leukemic cell lines.4 These tests may be cheaper, more sensitive, and more specific than those now available.

The ELISA test compares the mean absorbance of a control negative serum and paired serum that is allowed to react with antigen of disrupted whole HTLV-III virus (H9 cell line). The comparison of optic density is reported as an ELISA ratio.63 Elevated ratios are likely to be found in patients with past or present infection with HTLV-III. The specific ratios that are diagnostic for the presence or absence of HTLV-III infection are dependent on the population being studied. The WB analysis uses electrophoretically produced immunoblots of disrupted HTLV-III virus and protein migration standards to detect the presence of antibodies to HTLV-III proteins.62

In the general population, the ELISA test is extremely sensitive with few false negatives and is, therefore, used as a screening test for HTLV-III antibody.63 However, it is not as specific for HTLV-III antibody as WB analysis and may provide false positives. Blood that is repeatedly positive by ELISA is then tested by WB analysis. The WB test is less sensitive than ELISA but is extremely specific and often used as a confirmatory test of the presence of HTLV-III antibody.62 Because it is less sensitive than ELISA, the WB test may give a false negative result with a low titered but positive ELISA sample.64 Also, the WB test may give false positive results.64 However, the combination of these two tests results in low false positive and negative rates in the general population.

Risk Populations

AIDS has occurred primarily in well-defined groups. Homosexual and bisexual men comprise more than 70% of reported AIDS cases.10 A large percentage of asymptomatic homosexual men are known to be antibody positive for HTLV-III.14 The next most common group consists of intravenous drug abusers, comprising 17% of reported AIDS cases.5 Large percentages of asymptomatic populations of intravenous drug abusers are positive for HTLV-III antibody.17,18

There are other smaller groups at risk for HTLV-III infection. Recipients of transfusions of blood or blood products represent 1.9% of all reported AIDS cases. Seroepidemiologic and virus isolation studies of donor–recipient pairs and evaluation of high risk donors document HTLV-III transmission via transfusion of blood and blood products.26,65,66 Most high-risk blood donors have been asymptomatic chronic carriers of HTLV-III.5 In one study, HTLV-III was isolated from the blood of 22 of 25 donors identified as being high risk for HTLV-III infection and who donated blood for patients who later contracted transfusion-related AIDS.66 Patients receiving pooled clotting factors for correction of genetic factor defects or deficiencies may be exposed to HTLV-III.7 For example, asymptomatic hemophiliacs are positive for HTLV-III antibody in 39–85% of those tested.18–25 In addition, the chronic use of cryoprecipitate appears to be a risk factor for AIDS.5,67,68

Children are susceptible to HTLV-III infection primarily via perinatal transmission of the virus.69–72 As of July 28, 1985, 79% of children with AIDS had parents with either AIDS or ARC or who were at risk for HTLV-III infection.73 A child born via cesarean section at 28 weeks was positive for HTLV-III, suggesting that transmission occurred in utero.74 As of November 10, 1986, 13% of children with AIDS who had been reported to
the CDC were exposed by transfusion of blood or blood components.

The remaining AIDS patients are unclassified. It is believed that some of this group belong to the aforementioned groups but have been unwilling to divulge that information. Also among this group are people who may have been exposed to HTLV-III infection by heterosexual contact with a member of a high-risk group. The epidemiologic pattern of AIDS in central Africa suggests that heterosexual promiscuity may be a major factor in HTLV-III propagation. In Zaire, the ratio of male to female AIDS patients is nearly 1:1. In the United States, most heterosexual spread appears to have been from male to female. However, recent reports suggest that HTLV-III may be transmitted to men from female prostitutes. Many of these prostitutes may have been intravenous drug abusers.

Treatment of HTLV-III Infection

CURRENT EFFORTS TO CURE HTLV-III INFECTIONS

There is no successful treatment for HTLV-III infection at this time. Some research is focused on numerous ways to bolster the defenses of AIDS patients by reconstitution or stimulation of the immune system. For example, periodic intravenous gammaglobulin has been used in patients with Pneumocystis carinii pneumonia and, in one series, was more effective clinically and by immunologic standards than conventional treatment with trimethoprim–sulfamethoxazole and pentamidine isethionate. Complete renovation or modulation of the immune system with bone marrow or lymphocyte transplantation is being evaluated. Enhancement of the immune system with the use of lymphokines has been suggested. Lymphokines are secreted by lymphocytes in response to an antigen exposure and stimulate immune function. This production is impaired in HTLV-III–infected patients. Examples of agents used in this regard are interleukin-2, alpha and gamma interferon, and isoprinosine. These agents may alter immune function but are, thus far, without clinical efficacy in treating patients with AIDS.

Despite current efforts at immunomodulation, infection with HTLV-III persists, and thus antiretrovirus therapy must be sought and found before immune reconstitution can be considered. A number of different agents have recently been evaluated that may have activity against HTLV-III. These agents might interfere with any one of several processes: 1) the attachment of HTLV-III at lymphocyte receptors; 2) the formation of DNA from viral RNA; and 3) the assembly and release of viral protein. Many of the agents being studied have some activity as inhibitors of reverse transcriptase. Multicenter trials are underway to evaluate these agents.

An obvious area of intense investigation is the development of a vaccine against HTLV-III. Because many strains may exist, a vaccine must be developed that has an antigen common to all strains. Prospects for a vaccine have been reviewed in detail.

TREATMENT OF ASSOCIATED MEDICAL PROBLEMS

The associated opportunistic infections and malignancies of AIDS are difficult to treat. Indeed, if there is a response to treatment, recurrence is common. Despite all efforts, mortality of AIDS continues to approach 100% at 30 months. For example, in treating Kaposi’s sarcoma, the results generally have been dismal. Responses to chemotherapy do occur, but survival is not affected. The treatment of opportunistic infections such as P. carinii pneumonia is equally frustrating and perhaps more significant because most morbidity and mortality in these patients is secondary to opportunistic infections rather than malignancies. In this regard, antimicrobials like trimethoprim–sulfamethoxazole and pentamidine isethionate may successfully control acute infection in patients with P. carinii pneumonia, but relapse is common. The organism is known to persist in lung tissue despite 2–3 weeks of drug therapy.

Prevention by Public Education

Prevention of AIDS and other HTLV-III infections must be directed at decreasing exposure. Currently, public awareness of modes of transmission of HTLV-III and methods to avoid exposure is the only way to prevent HTLV-III infection. Education is particularly important regarding sexual habits and the use of sterile needles for illicit drug use in high-risk populations. Many homosexual men are aware and concerned about HTLV-III infection, and some are changing their sexual lifestyles. The efficacy of these changes, primarily to sexual relationships with fewer partners and the use of condoms, remains to be seen.

Implications of HTLV-III for Anesthesiologists

Numerous questions relating to HTLV-III transmission and our anesthetic practices may arise. What do we tell our patients regarding the safety of possible transfusions? What protective measures do we take to prevent transmission of HTLV-III infection? What measures do we take to protect ourselves from exposure to HTLV-III? What procedures do we follow if we accidentally stick ourselves with a contaminated needle? These questions
and others relating to protection of our patients and ourselves are further complicated by the presence of many unrecognized, asymptomatic carriers of HTLV-III.

**BLOOD SAFETY**

In 1982, the first cases of AIDS in blood transfusion recipients were recognized.61 A significant number of hemophiliacs and transfusion recipients developed AIDS, warranting their inclusion into a unique risk population. Great concern was generated over the safety of the nation's blood supply. With no serologic markers yet available to detect the presence of HTLV-III or its antibody, blood collection agencies requested that members of recognized high-risk groups voluntarily refrain from donating blood.92,93 The success of this request in decreasing the volume of donated, HTLV-III-infected blood is unclear.94-96

In 1984, the development of tests to detect antibody to HTLV-III in blood provided the necessary tools to screen donated blood for the presence of HTLV-III. In the fall of 1984, the U.S. FDA licensed five manufacturers to produce and evaluate screening tests to be used on donated blood.97,98 The first such tests were approved in March, 1985. Thereafter, all blood and blood products have been screened with the ELISA test to identify HTLV-III-infected blood.

Preliminary testing results by the American Red Cross project a prevalence of 88 donors positive in both ELISA and WB tests per 100,000.94 How good are these tests? Although quite specific and sensitive, they are imperfect.99 For example, HTLV-III has been isolated from the blood of people who have tested negative for HTLV-III antibody in both ELISA and WB tests.95 Therefore, a risk of becoming infected with HTLV-III persists.100 Also, because the incubation period from transfusion of an infected unit to the onset of AIDS may be 5 years or longer, it is expected that cases of transfusion-related HTLV-III infection will continue to appear.

Other methods may decrease the risk of HTLV-III exposure from transfusion of blood or blood products. The use of heat-treated, pooled coagulation factors may eliminate transmission of infectious HTLV-III to hemophiliacs. Present methods do not allow detection of HTLV-III in Factor VIII that has received low levels of heat treatment.101-105 In addition, autologous blood transfusions and intraoperative cell salvage techniques are being encouraged.

**HOW INFECTIVE IS HTLV-III?**

Epidemiologic data indicate that this virus is transmissible by sexual contact, use of contaminated needles by intravenous drug abusers, perinatal transmission, and transfusion of blood or blood products. These patterns of transmission are similar to that of hepatitis B virus (HBV). Nearly all patients with AIDS are concomitantly positive for the serologic markers of HBV. In fact, prior to the availability of HTLV-III antibody testing, detection of antibody to hepatitis B core antigen (HBcAg) was suggested as a surrogate test to identify persons at risk for AIDS.104

Many body fluids that anesthesia personnel may contact contain lymphocytes that can harbor HTLV-III. Although only blood and semen are definitely known to transmit the virus, other media, including CSF, saliva, urine, stool, tears, and breast milk, may contain the virus. Transmission of the virus by these media has not been documented, although a case report suggests transmission of HTLV-III from mother to infant via breast milk.105

The presence of HTLV-III in saliva should be particularly interesting to anesthesiologists. Fortunately, HTLV-III isolation from saliva using available methods is uncommon. The virus was cultured from saliva in only one of 71 homosexual men who were seropositive for HTLV-III.112 In this patient, the amount of virus present was quite small compared with the amount in his blood.

There is no evidence that HTLV-III is spread by casual contact, sneezing, or coughing. Studies of family members exposed to a sibling, parent, or child with AIDS fail to document intrafamilial spread except by intimate sexual contact or from mother to child during the perinatal period.113 Even after prolonged contact with AIDS patients and sharing of razors, toothbrushes, and eating utensils, nonsexual household contacts are at minimal risk for HTLV-III infection. Excluding one report of probable transmission of HTLV-III from a child to his mother, who had extensive and unusual exposure to his blood, secretions, and excretions over a prolonged period,114 infants that have contracted AIDS from blood transfusions do not appear to transmit HTLV-III to other family members.51

The risk of HTLV-III transmission to health care workers is remote.115 As of December 31, 1985, only two individuals in 938 health care workers who had documented percutaneous or mucosal exposures to blood and body fluids from patients infected with HTLV-III appear to have become seropositive.116 In fact, levels of antibody to HTLV-III from these two individuals were obtained after their exposure and thus do not prove nosocomial transmission. Nevertheless, these cases suggest the potential spread of HTLV-III to health care workers.

Because there is a remote possibility of becoming infected after exposure to HTLV-III in blood or secretions, health care workers should exercise caution when using...
needles and handling specimens. In a recent CDC surveillance project, 40% of health care workers exposed to blood or secretions of patients with AIDS or ARC could have avoided the exposure if they had followed CDC-recommended precautions. Health care workers not exposed to blood or secretions are probably safe from HTLV-III transmission without precautions other than routine hygienic care.

**How Hardy Is HTLV-III?**

Viruses may survive for prolonged periods outside the host organism. For instance, HBV can survive drying and storage at 25°C and 42% relative humidity for 1 week. HTLV-III can be recovered from dried material after 3 days at room temperature. In an aqueous environment, it can survive longer than 15 days at room temperature.

Fortunately, the HTLV-III virus is quite sensitive to a wide range of disinfectant chemicals. For example, the CDC recommends the use of an Environmental Protection Agency (EPA)-registered “hospital disinfectant” having a label claim for mycobacterial activity or dilutions of household bleach (1:10 to 1:1,000, depending on the amount of organic soilage on the item to be disinfected). Mycobacterial disinfectants are preferred because mycobacteria are one of the most resistant microorganisms; therefore, mycobacterial germicides are also effective against most viral pathogens. Specific label claims of common germicides can be obtained by writing to the Disinfectants Branch, Office of Pesticides, Environmental Protection Agency, 401 M. Street SW, Washington, DC 20460. There should be no specific HTLV-III label claims at this time. The EPA has not yet accepted or approved such claims.

HTLV-III is also quite susceptible to low levels of heat. For example, HTLV-III in an aqueous solution is inactivated by 10 min at 56°C. The common hospital sterilization techniques using ethylene oxide, steam, and boiling water kill all viruses except Creutzfeldt-Jakob disease virus.

**How Do We Protect Our Patients?**

Good hygienic practices should be used in the care of all anesthetized patients. Patients without HTLV-III infection need to be protected from exposure to the virus. Patients with HTLV-III infection may be immunosuppressed and need to be protected from opportunistic infections.

Despite the success of screening blood donors, the most probable route of HTLV-III transmission to our patients remains the transfusion of blood or blood products. Other theoretical possibilities include transmission from HTLV-III-infected anesthesia personnel and exposure to contaminated anesthesia equipment. We have already reviewed steps taken to decrease the risk of transmission by transfusion of blood or blood products.

Transmission of HTLV-III from infected anesthesia personnel is possible, but there is no evidence for such risk. For this event to occur, patients would have to be exposed to blood or serous fluids from an infected person. In addition to this exposure, these patients would also need a portal of entry for the virus, such as a small mucosal tear following laryngoscopy. Such transmission of HTLV-III infection is unlikely. However, similar cases of viral transmission have occurred and resulted in transmission of HBV from medical workers to patients. In these situations, the workers had high concentrations of HBV in their blood (≥10⁸ virus particles per ml of serum). If a high viral concentration is a factor in transmission of infection, HTLV-III should not be as easily transmitted. The concentration of HTLV-III in the blood of patients with AIDS is 0–1,000 virus particles per ml.

Transmission of HTLV-III via anesthetic equipment contaminated by a previous patient who was infected with HTLV-III may occur theoretically. Viruses have been recovered from small particles produced by sneezes and coughs. Airborne infection with Coxackie virus A type 21 is possible, and both adenovirus type 4 and influenza virus appear to be transmitted by small-particle aerosol. However, viruses have not been cultured from anesthetic circuitry.

Bacteria from a wide variety of sources can survive and proliferate in the circuitry of our anesthesia machines. To prevent bacterial spread via airway circuitry, disposable airway circuits, filters, and carbon dioxide absorbers have been used. Controlled studies using disposable items have been equivocal and controversial in documenting a decrease in bacterial pneumonia postoperatively. In contrast, viruses do not grow outside of a host organism. Any viruses present in contaminated circuitry cannot multiply or increase the inoculum size. Given the probable decreased risk of viral compared with bacterial spread in airway circuitry, the scientific data to justify the use of disposable anesthesia equipment to prevent the spread of viruses are speculative at best; nevertheless, a number of anesthetic departments in this country that deal with large numbers of HTLV-III-infected patients or patients in high-risk groups are using disposable breathing circuits and, occasionally, carbon dioxide absorbers.

Only those parts of the breathing circuit that may be directly contaminated with sputum or other organic materials containing viruses provide sources for viral spread. These items should be washed and sterilized or subjected to appropriate disinfection. If this practice is not fea-
sible, we recommend the use of disposable breathing circuits. Except in unusual situations where spum and other viral-containing organic materials may extend beyond the expiratory limb, we do not recommend the use of disposable carbon dioxide absorbers.

Laryngoscopes and other nondisposable items that have touched mucosal membranes or contacted blood or secretions from patients should remain separated from clean equipment, be thoroughly washed with a detergent and water, and either gas or steam sterilized or subjected to appropriate disinfection. An alternative is to submerge these washed items in boiling water for 10 min. Persons cleaning this equipment should wear disposable gloves. Environmental surfaces, such as those of the anesthesia machine that are contaminated, should be disinfected with an EPA-registered "hospital disinfectant" having a label claim for mycobactericidal activity. Alternatively, a 1:10 to 1:1,000 dilution of sodium hydrochlorite (household bleach) may be used, depending on the amount of residual organic material. As with the anesthesia circuitry, disposable laryngoscopes, esophageal stethoscopes, and other equipment that could be contaminated are being used by some anesthesia departments.

PROTECTING OURSELVES

Patients with HTLV-III infection, including AIDS, should not be treated differently than any other patients. In all patients, emphasis should be placed on avoiding contact with potentially infectious blood or secretions.

1. Needles and other sharp items contaminated with blood should be handled with extraordinary precaution. They should not be recapped, bent, broken, or removed from disposable syringes. Most needle-stick injuries occur during recapping. These items should be placed intact into puncture-resistant containers. All disposed items should be properly contained and identified.

2. Gloves should be worn for any anticipated exposure to blood or secretions. Furthermore, masks and goggles or protective glasses may be worn during laryngoscopy or suctioning of the endotracheal tube if splashes of body fluids are a possibility. Hands should be thoroughly washed as soon as possible, even if gloves are worn.

3. Ventilation and airway equipment should be nearby to minimize the possible need to perform mouth-to-mouth resuscitation.

What to Do if You Have a Needle-stick or Mucosal Exposure. The patient should be evaluated for the clinical and epidemiologic likelihood of viral infection such as HBV or HTLV-III. Regarding the latter, if the assessment does not suggest the presence of HTLV-III infection, you will need no further follow-up. However, if the likelihood of HTLV-III infection exists, the patient should be informed of the incident and asked to consent to serologic testing. If the patient declines testing or has a positive test, you should have serologic testing as soon as possible. If you are initially seronegative, you should be retested after 6 weeks and on a periodic basis thereafter to determine if transmission has occurred. Most infected persons will seroconvert within 6–12 weeks. During this time, you should receive counseling about the risk of infection and also prevention of possible transmission of HTLV-III to others.

What to Do if You Are Pregnant. Pregnant anesthesia personnel are not known to be at more risk of contracting HTLV-III infections than those who are not pregnant. However, because fetuses and infants of infected mothers are at increased risk of infection, pregnant personnel should be well informed of the modes of HTLV-III transmission and familiar with precautions for preventing its spread. In particular, because HTLV-III-infected patients are often concomitantly infected with cytomegalovirus, pregnant individuals should be extraordinarily cautious when caring for these patients. Further information regarding risk of pregnancy and perinatal transmission of HTLV-III from mother to fetus or infant may be found in an excellent review from the CDC.

What to Do if You Have an HTLV-III Infection

As discussed previously, the risk of transmitting HTLV-III to a patient is extremely slight. Nevertheless, the CDC makes the following recommendations: You should wear gloves for any direct contact with a patient's mucosal membranes or nonintact skin. If you have exudative lesions or weeping dermatitis, you should refrain from all direct patient contact for the duration of these lesions. If you are symptomatic or have any acute illness, you should not be working, because your illness may interfere with your abilities and adversely affect patient care. If a patient is accidentally exposed to your blood or serum fluids, the patient should be informed of the incident and have serologic testing as soon as possible. Further care should be identical to that previously proposed following needle-stick exposure. In addition, you might have some degree of altered immunologic defenses and be at increased risk for becoming infected with various organisms from your patients.

Should We Test All of Our Patients for Serologic Markers of HTLV-III Infection?

Because the risk of transmission of HTLV-III infection, even with documented needle stick, is extremely low, such testing is unlikely to further reduce the risk of transmis-
In low-risk populations, the false positive rate may be confusing and require additional tests for diagnostic accuracy. Screening of patients in identifiable high-risk groups or of all patients in certain geographic areas in which there are many high-risk groups may be considered. However, in these patients, why screen at all? If the test is negative, you would still use good hygienic practices. The result of the test should not alter your practice.

Summary

The effects of the current HTLV-III epidemic are of considerable significance to the general public and health care system. It is a new disease with diverse ramifications... not all of which are understood. Many drugs are being evaluated in clinical trials, but at present, they are not expected to be able to rid an infected individual of HTLV-III. There is hope for an effective vaccine, but its development is not anticipated in the near future. For now, prevention of exposure is our only means of decreasing HTLV-III transmission.

We will be caring for increasing numbers of patients with HTLV-III infection. Some of these patients will have AIDS or ARC. However, a much larger pool of patients will have asymptomatic, unrecognized HTLV-III infections. Therefore, all of our patients should be treated with good hygienic practices. Appropriate guidelines can help ensure our safety as well as that of our patients. The evidence is overwhelming that HTLV-III is spread sexually, by injection of contaminated blood, and from mother to fetus. Our highest personal risk for becoming infected with HTLV-III is by parenteral introduction via contaminated needles or other sharp objects. We must realize that despite the routine close contact with blood and body secretions of patients inherent to our profession, we are at little risk for becoming infected. Furthermore, with care and vigilance, we can protect our patients from risk of infection with not only HTLV-III, but a wide variety of other infectious agents as well.

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References

1. CDC: Kaposis sarcoma and Pneumocystis pneumonia among homosexual men—New York City and California. MMWR 30: 305–308, 1981


7. CDC: Update on acquired immune deficiency syndrome (AIDS)—United States. MMWR 31:507–514, 1982

8. CDC: Revision of case definition of acquired immunodeficiency syndrome for national reporting—United States. JAMA 254: 599–600, 1985


14. CDC: Antibodies to a retrovirus etiologically associated with acquired immunodeficiency syndrome (AIDS) in populations with increased incidences of the syndrome. JAMA 252:608–609, 1984


21. Ramsey RB, Palmer EL, McDougal JS, Kalyaranaram VS, Jackson DW, Chorba TL, Holman RC, Evatt BL: Antibody to lymph-
43. Penn I: Malignancies associated with immunosuppressive or cytotoxic therapy. Surgery 83:492–502, 1978
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75. Redfield RR, Markham PD, Salahuddin SZ, Sarnaghadhar MG, Bodner AJ, Folks TM, Ballou WR, Wright DC, Gallo RC: Frequent transmission of HTLV-III among spouses of patients with AIDS-related complex and AIDS. JAMA 253:1571–1575, 1985


84. Danner SA, Schuurman H-J, Lange JMA, Meyling PHJG, Schel-


90. CDC: Self-reported behavioral changes among homosexual and bisexual men—San Francisco. JAMA 254:2537–2538, 1985


98. CDC: Provisional public health service inter-agency recommendations for screening donated blood and plasma for antibody to the virus causing acquired immunodeficiency syndrome. MMWR 34:5–7, 1985

99. Cable RG, Kakiya RM, Roberts SC, Martin CR, Shafer AW, Thaxton J: Follow-up testing of blood donors found to be enzyme immunoassay positive/Western Blot negative for HTLV-III antibody. JAMA 256:40–41, 1986


106. CDC: Recommendations for preventing possible HTLV-III/LAV virus from tears. JAMA 254:1429–1436, 1985


121. CDC: Summary: Recommendations for preventing transmission of infection with HTLV-III/LAV in the workplace. JAMA 254:3162–3168, 1985


124. Committee on Health Care Issues, American Neurologic Al-


