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The acquired immunodeficiency syndrome (AIDS) virus is now called the human immunodeficiency virus (HIV). By attacking the immune and nervous systems, HIV causes a broad range of disease ranging from none to fatal. The fatal illness AIDS represents end-stage disease of the immune system. However, at any given time for every one person with the fatal illness there may be 50 to 100 infected people who have no or milder illness.

The manifestations of HIV infection are both primary, those due directly to the virus itself, and secondary, those due to immune damage. The secondary manifestations were the first recognized and are characteristic of immune deficiencies in general. These are: 1) infections, including opportunistic infections; 2) tumors, including certain "opportunistic" tumors such as Kaposi's sarcoma and lymphomas (both of which also occur in transplant patients); and 3) other phenomena of immune dysregulation including autoimmune phenomena, of which thrombocytopenic purpura is the most common. The primary manifestations of HIV infection have been recognized only recently, and it is likely that more remain to be defined. Two well-recognized manifestations are 1) an acute infectious-mononucleosis-like illness that occurs within one to eight weeks of initial infection, and 2) a spectrum of neurological illness. Neurologic symptoms may occur as an acute transient process shortly after infection or at any time during the course of the disease. Other manifestations that may prove to be due to HIV itself include interstitial pneumonia and gastrointestinal disorders, particularly diarrhea.HIV has been shown to infect certain cells in the body—the T-helper lymphocytes, the monocyte/macrophages, and some central nervous system cells. It is not clear to what extent other cells in the body are infected, such as B-lymphocytes and intestinal cells. There is a recent description of in vitro infection of primary colonic epithelium.

The HIV attack on the immune system is especially devastating because it strikes the "commander" of the immune system, the T-helper lymphocyte, as well as "frontline troops," the monocytes/macrophages, which are the antigen-processing and presenting cells. Since the T-helper lymphocyte controls at least six other reactions in the immune system, including most B-cell function, immune deficiency due to HIV involves much more than cell-mediated immunity. Thus HIV can cause immune deficiency more profound than that of any other acquired form of immune deficiency and is comparable only to that of congenital severe combined immunodeficiency (SCID). Unlike SCID, however, one cannot save AIDS patients by shielding them in a "bubble" because they already have acquired the latent opportunistic pathogens that will kill them. Bone marrow transplantation has yet to be successful in AIDS.

Virology

Retroviruses, the family to which the AIDS virus belongs, are RNA viruses. They make a DNA copy of themselves by a unique enzyme, reverse transcriptase. This DNA copy, the provirus, inserts itself (ie, becomes integrated) into the chromosomes of certain host cells; thus, infection is generally lifelong. Retroviruses can cause a range of effects: none, latent infection, cell damage, malignant transformation, or cell death. Retroviruses produce proteins that are transactivating. These transactivating factors can affect the function of adjacent and distant genes on the chromosome at the level of both transcription (the making of RNA from DNA) and translation (the making of proteins from RNA). Transactivating factors can increase the activity of other genes by a thousandfold or more. In fact, retroviral transactivating factors are being used to study the gene products of many different cells.

Retroviruses are divided into three groups: the oncoviruses (tumor-producing), the lentiviruses (slow viruses), and the spumaviruses (foamy viruses). HIV belongs to the second group, the lentiviruses. The first recognized human retroviruses, HTLV-I and HTLV-II, as well as most known animal retroviruses (starting with Rous' sarcoma described in 1911) are oncoviruses—that is, they directly produce malignant transformation of infected cells. On the other hand, HIV is not itself oncogenic. The malignancies characteristic of AIDS probably result from other common viruses acting "opportunistically" oncogenic due to the immune deficiency. For example, the B-cell lymphomas which occur in AIDS (and transplant patients) are probably caused by the Epstein-Barr virus. Kaposi's sarcoma may possibly be due to cytomegalovirus.

In a sense, the lentiviruses are worse than the oncoviruses. The prototype of the lentivirus group is visna, a neurologic disease of sheep. Despite the economic importance of this infection, efforts to develop a vaccine have failed for over a decade. The visna virus constantly modifies its antigens thus eluding the

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host immune system. In this respect HIV closely resembles the visna virus, which implies similar difficulties in developing a HIV vaccine. The only successful retroviral vaccine developed to date is for an oncovirus, that of feline leukemia. Feline leukemia is different from HIV disease in that some cats develop a natural immunity to this disease. It is unlikely that a vaccine or cure for HIV infection will be developed in less than five to ten years and it could take 20 or more years. Because the HIV DNA provirus becomes part of the genome of lymphocytes, monocytes, and perhaps other cells, true cure requires the ability to excise parts of human DNA.

AIDS is a disease that is going to be with us for a generation or more. Most Americans will never catch HIV, but most will come to have personal experience with the disease through someone they know—a family member, friend, or co-worker. No health care worker will be able to avoid caring for HIV-infected persons. HIV infection will saturate those populations where people continue high-risk behavior and where infection rates are already very high—certain homosexual/bisexual men and intravenous drug abusers. The infection will spread, probably more slowly but inexorably, as a sexually transmitted disease in the general heterosexual population. The challenge is to curtail its spread and control the accompanying epidemic as well, that of AIDS hysteria.

AIDS Hysteria

AIDS hysteria is as alarming as AIDS itself. Unfortunately, AIDS hysteria is still socially acceptable in our country, while hysterical behavior in any other potentially life-threatening situation is not. Even many health care professionals regard it as "reasonable" to refuse to treat AIDS patients. The first step in combating hysteria is to understand how HIV may have originated. Diabolical as HIV seems, it appears to be just another one of Mother Nature's nasty tricks.

The current best hypothesis is that HIV arose perhaps 30 to 40 years ago in central Africa from a mutation of a very similar simian virus, STLV-III. The STLV-III virus is found in the African Green monkey which associates closely with man and is killed by man for food. The most likely route of transmission to man may have been through skin cuts during the butchering process. In Africa infection may have originated as a rare rural disease; then, through population shifts, it became what it is today, a common urban disease.

The next step in tackling AIDS hysteria is to acknowledge two very deep-seated irrational fears of man: the fear of contagion and the fear of homosexuality. Because of personal experience with highly contagious infections like the common cold and the history of epidemics of influenza, smallpox, and plague, most people believe that all infections are easy to catch, and they fear being around anyone with an infection of any kind. It is very difficult to convince people that some infections, such as HIV, are very difficult to catch.

Homophobia, the fear of and prejudice against homosexuality, is prevalent in our society. Yet sexual preference seems to be acquired at a very early age, may even be genetic, and almost never can be changed. About 10% of our fellow humans are homosexual or bisexual. This includes 10% of our sons, grandsons, brothers, and male friends and co-workers. Nevertheless, homosexuality is still taboo and illegal in most areas. The homosexuality of one's own sex is more threatening than that of the opposite sex. Thus heterosexual males may have more difficulty in dealing with AIDS. Unconsciously, men may feel that showing any interest in HIV disease or placing themselves at the slightest risk of catching it might make some people think that they are homosexual. Often the husbands and boyfriends of female health care workers will strongly object to their working with AIDS patients and will insist that the women wash and change clothes completely before coming home.

The dangers of letting hysteria remain unchecked are underappreciated by most people who are unaware of the barbaric outcome of uncontrolled social and religious hysteria in human history. The idea that disease is God's punishment is a powerful and pervasive human belief. Two theories are commonly invoked. The first theory is that the disease, such as AIDS, is God's punishment on a certain individual for his or her sins. This theory does not explain 1) the infection of "innocent victims" such as children, or 2) why both heterosexuals and male homosexuals are affected and lesbians are not. The second theory is much more dangerous: the disease is God's punishment on all of us because of the sins of some of us (those "some" being "sinners" and "heretics"). This is the theory that has led in the past to mass murder. For example, during plague epidemics in the Middle Ages the common response was for Christians to slaughter Jews in the belief that the presence of these heretics had angered God and caused Him to bring the disease upon everyone. The Spanish Inquisition carried this concept of eradication of heretics to its extreme, but was not successful in ridding Spain of disease.

Hysteria is harmful because it wastes tremendous amounts of time, money, and energy which are needed to fight the real epidemic of AIDS. The medical consequences of this hysteria include 1) shortage of blood donations (the number of blood donations is still significantly less than before AIDS, since people still wrongly believe that AIDS can be acquired by giving blood); 2) underuse of the valuable hepatitis B vaccine; and 3) refusal of patients to accept necessary blood transfusions. Incalculable is the amount of unnecessary emotional stress on both patients and staff that is caused by this hysteria.

The final step in dealing with hysteria is for people to be receptive to the actual data on transmission of HIV. The public as well as medical personnel still have many misconceptions regarding HIV transmission. There is confusion over the incubation period and unfamiliarity with transmission data regarding the large numbers of household contacts and health care workers who have been studied and who have tested negative for HIV.

AIDS Incubation

Confusion over the incubation period is understandable since there are actually five incubation periods which are pertinent to HIV infection. They involve the time from becoming infected with HIV to 1) viremia and potential contagiousness, 2) antibody (test) positivity, 3) acute illness, 4) symptoms of any kind, and 5) AIDS itself. A common misconception is to mistake incubation period #5 for #2; that is, many think that it will take

five years to detect if anyone has been infected with the AIDS virus after being exposed to it, but actually the antibody test provides the information usually within three months of exposure. Our current knowledge of these incubation periods suggests the following time table:

1. Time to viremia (hence potential contagiousness through blood and sex): one to three weeks.

2. Time to antibody positivity (time for the blood test to become positive): usually between two to three months, occasionally longer, possibly up to six to 12 months.

3. Time between infection and the transient acute illness (which may be infectious-mononucleosis-like or neurologic): one to eight weeks.

4. Time to development of any sort of symptoms: one week to indefinitely.

5. Time to development of full-blown AIDS (fatal disease): six months to seven or more years, averaging five or more years in adults; zero (birth) to seven years in perinatal infection, averaging one and one-half to two years in infants.

The last incubation period, the time to development of fatal disease, is probably still being underestimated. HIV infection is lifelong in most persons, and it appears that the risk of fatal disease exists throughout the life of the infected person. We do not know what percent of infected people will eventually develop AIDS, but it may be a large percentage, perhaps as many as 50% or more by ten years after infection and an unknown percent beyond that time.

Transmission of AIDS

Sexual relations

HIV infection is in nature a sexually transmitted disease of human beings. There is nothing unique about homosexuality and this disease. In Africa the disease is a widespread heterosexual infection. Through some capricious set of circumstances, the first persons infected in the United States were homosexual men. HIV is present in semen, vaginal, and cervical secretions. The virus is frequently transmitted by heterosexual or male homosexual relations, but lesbian transmission is extremely rare with only two possible cases reported. It is likely that male-to-female transmission is more effective than female-to-male transmission. The risk of transmission appears to be very high during anal intercourse, fairly high during vaginal intercourse, and fairly low during oral intercourse. Because the rectal lining is more delicate than that of the vagina or mouth and tears and bleeds more easily, infection inoculated in the rectal lining seems more likely to have direct access to the bloodstream. An additional factor that may increase risk of anal infection is that semen itself is immunosuppressive if it reaches the bloodstream.

Fortunately, AIDS is less readily transmitted sexually than many other sexually transmitted diseases. Some people can be exposed many times and still not contract the infection. However, some people do become infected after only one or two episodes of coitus. These differences in susceptibility among exposed persons probably relate to three factors: 1) degree of infectiousness of the carrier, 2) general state of health of the exposed persons (including other concurrent infections), and 3) genetic susceptibility of the exposed person. These factors are probably very important in determining the likelihood of infection when the exposure is to relatively low doses of virus, such as by sexual contact and needle stick. On the other hand, when the exposure is to large doses of virus injected directly into the bloodstream, ie, when an infected unit of blood is received, almost no one is resistant to infection.

Heterosexual relations

Regarding heterosexual transmission, in the United States women represent only 7% of AIDS cases, and half of these women are infected from intravenous drug abuse, not sexual relations. In central Africa women comprise 50% of the cases, and transmission is almost all sexual.

In urban areas of central Africa 20% to 88% of female prostitutes are infected with HIV heterosexually. However, in the United States and Europe, most prostitutes become infected from intravenous drug abuse, since the pool of infected heterosexual men is very small outside the drug abusing population. Street prostitute infection rates of 13% in Detroit and 58% in Newark, New Jersey, where there are large numbers of infected drug abusers, are not surprising. There has been to date in the United States what would seem to be less cases than expected among male customers of female prostitutes. Possible reasons for this include health and genetic factors, a lower risk of female-to-male transmission, and the American male's frequent preference for fellatio. (In Africa sex with prostitutes virtually always involves vaginal intercourse.)

The risk of male-to-female transmission as measured by the rate of seropositives among steady female partners of infected males has ranged from 7% to 70% in various studies. Interestingly, analyses of these studies show that the men fall into two groups: one with a high transmission rate of 40% to 70%, and the other with a low rate of 7% to 30% transmission to female partners. The high-transmission group includes men who are 1) intravenous drug abusers; 2) heterosexual armed forces men (who often have acquired the infection from many prostitute contacts); or 3) African or Haitian men. The low-transmission group includes men who are 1) hemophiliacs, 2) other transfusion recipients, or 3) bisexual. In attempting to explain this discrepancy in risk of transmission to female partners, one hypothesis is that the high-transmission group can be characterized by a high incidence of other sexually transmitted diseases and/or malnutrition or poverty. Whether such a hypothesis is valid is unknown. Of concern is that these factors that may lead to a higher transmission rate are characteristic of our urban poor.

The rapid heterosexual spread of HIV in Africa is alarming: infection rates of mothers at a well-baby clinic in Zaire increased from 1% in 1980 to 5% in 1985 and in prostitutes in Nairobi from 8% in 1981 to 85% in 1987. Two factors in Africa could accelerate the heterosexual spread: 1) malnutrition and malaria may weaken the immune system, making persons more susceptible to HIV; and 2) the current raging epidemic of other sexually transmitted diseases in Africa may give rise to conditions in the genitalia that make an individual both more infectious and more susceptible to HIV. Several recent studies suggest that the presence of genital ulcer disease increases HIV transmission. In Africa, chancroid is very common, as well as herpes and syphilis, as a cause of genital ulcers. Even inflammation of the geni-

tal mucosa due to gonococcal or chlamydial infection may make the mucosa more permeable to HIV and lead to an outpouring of inflammatory cells, including the lymphocytes and monocytes which are the primary cells that are HIV-infected and HIV-infectible.

A recent preliminary report from Britain suggests increased likelihood of HIV infection and progression of HIV disease in persons carrying one of the three alleles of group specific component (Gc factor, which is the vitamin D receptor present in blood and on the surface of cells). Population studies have shown that the proportion of persons heterozygous or homozygous for the unfavorable allele is around 15% in whites in Europe and the United States versus 60% in blacks in Africa. This raises the very alarming possibility that blacks could be more susceptible to HIV on a genetic basis.

Another recently described variable that may influence het erosexual (and presumably homosexual) transmission of HIV is the level of immune function of the infected person. Transmis sion appears greater when immune function is lower, possibly due to higher titers of virus in blood and presumably semen. In studies by Redfield et al among seropositive heterosexuals in the armed forces (almost all male), the percentage of spouses who were seropositive was 16% (3/19) when the index case had a nor mal number of T-helper cells ($> 400/\mu L$), 25% (2/8) when the number of T-helper cells was below 400 but AIDS-related com plex (ARC) or AIDS were not present, and 56% (13/25) when ARC (as indicated by thrush) or AIDS were present. This finding has potentially ominous implications. To date, among hemophiliacs and even bisexual men, very few spouses and almost no children have been infected. Most infected children in the United States are offspring of intravenous drug abusers. This low incidence of infection in spouses and children of hemophiliacs and bisexual men could change over the next five years. Since most infected persons show a decline in immune function over time, these men may become more infectious to their spouses. Also, pregnant women may be more likely to transmit HIV to the fetus if their immune function is low.

Blood transmission

Transmission of AIDS via blood is a special circumstance that accounts for few cases except among intravenous drug abusers and from mother to fetus. If a pregnant woman is infected, there may be a 50% chance that her child will be born infected. The risk of transmission of AIDS via blood transfusion is very low, probably in the range of one per 60,000 units of blood or less with present antibody screening. Transmission of fatal viral hepatitis (usually non-A, non-B) is at least six times more frequent. Present antibody screening and procedures to discourage high-risk donors have eliminated almost all transfusion-associated HIV transmission. However, it must be understood that a number of cases of AIDS among transfusion recipients will continue to occur due to infection acquired before the antibody screening began in the spring of 1985.

Hemophiliacs represent an exception to the rarity of AIDS transmission from blood products. The development of lyophilized Factor VIII concentrate, which can be administered at home, revolutionized the treatment of hemophilia and enabled many hemophiliacs to lead normal or almost normal lives. Unfortunately, the preparation of commercial Factor VIII concentrate involved the pooling of blood from enormous numbers of donors. A severe hemophiliac using Factor VIII concentrate at home could be exposed in one year to the blood products of up to 200,000 individuals. Almost all severe hemophiliacs who used large amounts of Factor VIII concentrate at home before 1985 have become infected. Since 1985, the clotting factor concentrates have been heat-treated and now are all antibody-screened as well. There has been no documentation of transmission from heat-treated, antibody-screened products, and transmission from products that have been heat-treated but not antibody-screened is extremely rare.

Certain blood products carry no risk whatsoever of HIV transmission. These include albumin (because it is pasteurized), immunoglobulins of all types (regular gamma globulin, HBIG, Rho-Gam, etc), the hepatitis B vaccine, and now the heat-treated, antibody-screening clotting factors. The fractionation process involved in the preparation of immunoglobulins has been shown to produce a 15 log reduction in the titer of HIV virus. Since the highest titer HIV found to date in human blood is 10^4 (4 logs), this provides an enormous safety margin. Also, steps in the preparation of the original hepatitis B vaccine (which was made from blood) kill all HIV so there is no risk.

Although antibody to HIV is found in many lots of immune globulins today, this has not produced even transiently positive antibody tests in recipients of intramuscular immune globulin. Rarely has there been transient ($\leq$ 30 days) weak-positive ELISA reactivity in persons receiving high-dose intravenous immunoglobulins.

Social contact

The Centers for Disease Control (CDC) term interaction with family, close friends, and co-workers as "casual contact," but actually mean intimate contact short of sexual relations. There is overwhelming evidence that such contact virtually never transmits HIV. To date, 715 individuals who have lived in the same household as someone carrying HIV but who are not sexual partners of the infected person or infants born while the mother was infected have been studied carefully. None of these 715 people are seropositive. Since half of the household contacts in all of these studies were children, the fear that school teachers with HIV infection will transmit the virus to their students seems totally unfounded.

The first of the household studies is an ongoing study through Montefiore Hospital in New York City. These AIDS patients are mostly poor, Hispanic, intravenous drug abusers living in very crowded conditions in New York City—certainly not an optimal situation regarding household hygiene. A total of 199 of these household contacts have been studied. Ninety percent of these contacts had shared the bathroom and kitchen, 50% had drunk from the same glass or eaten from the same dish before it had been washed, 30% to 40% had slept in the same bed (mostly children sleeping with their parents) and bathed with the patient, 10% to 15% used items that might draw blood such as razors, toothbrushes, or nail clippers, 83% kissed on the cheek, and 17% kissed on the lips. That none of these 199 nonsexual household members is seropositive is strong evidence against close personal contact short of sexual relations transmitting HIV.

In a second study the AIDS patients were children with transfusion-associated AIDS, most of whom shared toys with their siblings. Again, none of 85 household contacts are seropositive. Six different groups have looked at 269 family members of hemophiliacs, many of whom helped to administer the intravenous Factor VIII at home to the patients, and none of these individuals is seropositive. Also, none of the other 162 household contacts in four other studies are seropositive.

The only report of a seropositive household member involves a case from Germany of a seropositive 6-year-old brother of a 3-year-old boy who died of transfusion-associated AIDS. The route of that transmission is unclear. Although the author suggested a bite as a possible cause, the mother stated that the bite did not break the skin or cause bruising. More likely another route of transmission is possible, including blood mingling or even childhood sexual play.

Regarding teeth bites, in prospective studies there has been no documentation to date that bites can transmit AIDS. In the study of children with transfusion-associated AIDS, there were 15 instances in which the patient bit a sibling or vice versa, and none of the 15 siblings was seropositive. In another study a hemophiliac was injured in an automobile accident and suffered brain damage which caused him to bite people. He had ARC, his mouth was "always dripping with blood and saliva," and he bit 30 health care workers to the point of leaving scars, yet none of these individuals is seropositive. One of our own employees who was bitten by an ARC patient is seronegative at 15 months after exposure.

Other methods of transmission

Organ transplantation—Organ transplantation or donation of other body components such as semen carries a risk similar to that of a single unit of blood. Current policy is to screen all donors for HIV prior to organ transplantation. Thus, future transmission via these routes should be exceedingly rare.

Breast milk—Transmission may occur through breast milk. The one reported case involved a woman who after delivery acquired the infection from a blood transfusion. She nursed her baby for six weeks, and the baby was subsequently found to be infected. The virus has been isolated from breast milk on several occasions.

Tears and saliva—The possible presence of the AIDS virus in tears and saliva alarms the general public. What the public ignores is that there has been no evidence of transmission by these routes. Even though a small amount of virus may be present in tears and saliva in only a minority of infected individuals, no evidence suggests transmission by these routes.

Other body fluids—Relatively large amounts of virus may be present in cerebrospinal fluid and brain when the central nervous system (CNS) is infected. This certainly could present a risk of nosocomial transmission, although none has been reported to date. The virus is present in small amounts in urine in a minority of people but no transmission from this source has been documented. Cultures from feces have not yet been done because of technical difficulties, but the virus could be present in feces. There is no evidence of transmission from sweat.

Insects—There has been no evidence of mosquito or other insect transmission despite the theoretical possibility raised by certain laboratory studies. The strongest evidence against mosquito transmission is the absence of seropositivity in children ages five to 15 years in Belle Glade, Florida, and central Africa in areas where 5% to 10% of adults are infected. Children older than five and younger than 15 years are likely to have been born before their mothers became infected (since there were relatively few infected heterosexuals in the United States or Africa five years ago) and are likely to be too young to be sexually active themselves. Yet these are the very individuals who are in closest contact with their infected parents and most likely to be bitten by the same mosquito.

Common Misconceptions Regarding Transmission

The concern about insect transmission of HIV is an excellent example of the common error made by laypersons and medical personnel who fail to make the critical distinction between theoretical and actual routes of transmission. Anyone can dream up a thousand different theoretical scenarios for HIV transmission. However, one must look to the science of epidemiology, which is the study of disease transmission, to find the ways in which the infection is and is not really being transmitted among persons in contact with HIV-infected individuals.

Another source of confusion and potential hysteria is the CDC's list of AIDS cases by risk factors. At the bottom of the list is a group called "no risk identified." The general public often assumes that these are persons who contracted AIDS from toilet seats, food, etc, or other as yet unrecognized means of transmission. In fact, there is no evidence that this is so. Indirect evidence suggests that most of these persons have risk factors that they are unwilling to admit. This is understandable, given such sensitive subjects as homosexuality and drug abuse. A minority of these persons may have been unwittingly infected through sexual partners who had risk factors of which they were unaware.

Nosocomial Transmission

Although the routes of transmission of HIV and the hepatitis B virus are similar, fortunately the nosocomial transmissibility of HIV is much, much less. Many health care workers are not aware of this low risk of HIV transmission. The few instances of transmission have been well publicized, but the denominator—namely, how many other health care workers have been exposed and remain uninfected—is little known by many people. The difference between HIV and hepatitis B transmission is best exemplified by the data to date on needle sticks. In prospective studies up to 25% of those with needle sticks from hepatitis B carriers have seroconverted, whereas studies to date have shown seroconversion in only one of 514 needle sticks from HIV carriers. These are data from a compilation of five studies conducted by the CDC, National Institutes of Health, San Francisco General Hospital, University of California-Los Angeles, and the Communicable Disease Surveillance Centre in London (the British equivalent of our CDC), plus six of our health care workers who were not part of the CDC study. (Eight other Henry Ford Hospital employees are included in the CDC data.) In these

studies the exposures were not only needle sticks but other percutaneous exposures, such as scalpel cuts. I will use the term needle stick to stand for all percutaneous blood exposures. Of importance in the prospective studies was that blood was first tested within 30 days of the needle stick, to be sure that the individual had not previously acquired HIV, and was then tested again three months or more after the needle stick.

In addition to the one seroconversion from needle stick in the prospective studies of 514 individuals, three other anecdotal reports of seroconversion from needle stick have been reported in the world to date. All four of these reported seroconversions involved nurses, one each from the United States, Britain, France, and Martinique. Two of these nurses experienced inadvertent injection of blood in addition to the needle stick. Since there is no denominator for the three anecdotal reports, our best guess as to the denominator, and hence the risk, for needle stick transmission is from the five prospective studies previously cited: approximately one in 500 with a 95% confidence interval well below 1%.

This striking difference between hepatitis B and HIV transmission from needle stick is probably due to the enormous amount of hepatitis B virus in the blood versus the small amount of HIV in blood: hepatitis B carriers have 10^8 to 10^{13} viral particles per mL whereas HIV carriers have 10^1 to 10^4 (usually 10^1 to 10^2) viral particles per mL of blood.

In areas with a high incidence of HIV infection in North America and London, prospective studies of health care workers without risk factors in their private lives have shown only one seropositive individual (the American nurse who had suffered a needle stick) among the 2,499 tested. Among dental workers (75% dentists, 60% of whom practiced in high-risk areas), only one of 1,795 was found to be seropositive, and this case is still under investigation to eliminate risk factors in the person's private life. This exceedingly low incidence of seropositivity among dentists is of particular interest since it is well known that dentists have been at a higher risk of hepatitis B than physicians.

Individual case reports of five other instances of transmission through patient care have been documented in the world. These instances apparently involved exposure of dermatitic skin to blood in three cases, blood in the mouth in one case, and in the last case extraordinarily poor hygiene on the part of the caregiver in the face of prolonged and intense exposure to blood and body fluids. Three of the five instances occurred among health care workers while on the job; in two of these instances the health care workers were not using the recommended precautions, and in the third case a very unusual accident occurred. The other two cases involved caregivers in the home, dealing with persons not recognized to be infected. One of these instances involved a mother who was a paramedic and who cared for her infant at home. The child was born with a congenital intestinal disorder requiring colostomy and causing heavy bleeding. The infant became infected from the transfusions, which went unrecognized for months. The mother was found to have seroconverted at the time of blood donation. Despite being a health care worker, the mother exercised very poor hygiene and usually did not wash her hands for some time after getting blood or feces on them. The other home care instance involved a British woman with extensive eczema on her hands and arms who cared for an ill neighbor until he died. The diagnosis of AIDS was unsuspected until postmortem examination.

To put the risk of these worrisome non-needle stick exposures in perspective, we need to consider the data on: 1) mucosal exposure in prospective studies, and 2) the previously mentioned serosurveys of health care workers. Regarding mucosal exposure to blood and body fluids, the five prospective studies previously mentioned also looked at such exposure and found no seroconversions in 493 individuals. Of the 4,294 medical and dental health care workers serosurveyed, only two were seropositive, one of which involved a needle stick. Many of these individuals doubtless had taken care of HIV-infected individuals without realizing it, and many probably at times had dermatitis or breaks in the skin.

Another way of viewing the health care worker risk is to see if health care workers are disproportionately represented among the persons in the "no identified risk" in the United States: in fact they are not. Health care workers make up about 5% of that group and 5% of the US population in general. Even in Zaire where the seropositivity rate among inpatients is very high and where hospital hygiene is very different (eg, nurses have to wash used needles before resterilization), the seropositivity rate among health care workers is the same as that of the general population, around 5%. This suggests that the increase in risk must be very slight, even in Zaire.

What does happen in the rare instances where there is transmission to health care workers? These instances may represent either patients who are particularly infectious (ie, those who have a high titer of circulating virus and/or a more infectious strain of virus) and/or health care workers who are particularly susceptible to HIV, possibly on a genetic or general health basis, or more likely a combination of these factors.

Regarding home care, many of the 715 household contacts mentioned previously helped care for AIDS patients at home, usually for some time (often years) before the diagnosis was made, and thus no special precautions were being used. This included many family members of hemophiliacs who helped administer infected intravenous Factor VIII at home.

Magnitude of the Epidemic

Over 36,000 people in the United States and about 360 individuals in Michigan as of June 1987 have had full-blown AIDS. With estimates of 50 to 100 carriers for every case of full-blown AIDS, we may have 2 million in the United States and at least 20,000 in Michigan who are carrying HIV infection. Among the persons in high-risk groups, the infection rates are astronomical. Of the homosexual or bisexual men in most large urban areas, 30% to 70% are already infected. Michigan has been fortunate in that the epidemic has been slower to spread, probably because Detroit is not a tourist mecca. A study one year ago suggested that only about 20% of Detroit-area homosexual or bisexual men were infected. The infection rate for intravenous drug abusers also ranges from 30% to 70% in many East Coast urban areas, yet is only 5% to 10% in the Detroit area. However, this is no cause for complacency. Two other areas with large numbers of intravenous drug abusers per capita, New York City and (curiously enough) Italy, have had astronomical increases over a five-year period in infection rates in intravenous drug abusers. In

both these areas HIV infection rates in intravenous drug abusers went from 5% to 10% in 1980 to 60% to 70% five years later in 1985. Thus, one can anticipate that by 1991, 60% to 70% of the estimated 30,000 to 40,000 intravenous drug abusers in Detroit will be infected. This also will lead to infection in at least half of the sexual partners, and one quarter of their babies, which means there may be hundreds of babies with AIDS in Detroit by 1991. Among hemophiliacs, because the Factor VIII concentrate was nationally distributed, the infection rates are the same throughout the United States. For those using that product at home before 1985, infection rates range from 70% to 100%.

If we had a vaccine tomorrow, we could not help many of the people in the high-risk groups because they are already infected. AIDS is the leading cause of death among gay men in urban areas. Because AIDS strikes young people, it has become the fourth leading natural cause of years of life lost in the United States behind only cancer, heart disease, and stroke. For a disease that was unknown six years ago, this is incredible. Central Africa faces a holocaust from this disease. In central Africa 5% to 20% of the general population are already infected with the virus, and public education campaigns have just started. Estimates are that there may be 5 to 10 million infected persons in Africa already, and these rates continue to escalate rapidly. Estimates for the United States by the year 1991 include: 1) more US citizens will have died of AIDS than have died in all the wars since World War I, 2) in that year for the first time AIDS will kill more people than are killed in motor-vehicle accidents, and 3) the number of infected persons in the United States could be as high as 5 to 10 million.

Symptoms

The CDC has devised a classification system for HIV infection based on clinical manifestations. An outline of this system is given in the Table (also see the Suggested Reading list, #6). Investigators are attempting to use this system for future studies. However, some commonly used terms such as ARC are not employed in the CDC system. In the following section commonly used terms will be explained along with reference to the CDC system terminology.

Persons infected with HIV may have symptoms ranging from none to fatal. The symptoms may occur at any time after infection, anywhere from one week to over seven years later. An unknown percentage of persons have an acute self-limited illness one to eight weeks after infection (CDC group I). The acute illness may be "mono-like" with fever, myalgias, lymphadenopathy, rash (in 50%), diarrhea (in 30%), or may be neurologic (aseptic meningitis, acute encephalitis, and Guillain-Barre syndrome have been reported). These manifestations will often resolve when they result from initial infection and are not to be confused with the progressive neurologic disease seen later in the course of HIV infection (CDC group IV-B). Between one-third and two-thirds of HIV-infected persons will develop lymphadenopathy at some time after infection, which may remain for years. This is termed persistent generalized lymphadenopathy (PGL) in the CDC classification (CDC group III). Lymphadenopathy will often disappear if the total number of lymphocytes in the body gets very low, ie, just before or at the onset of AIDS. Other nonspecific symptoms such as fever, night sweats, weight loss, and diarrhea are common as immune function gets low, but may occur transiently in those with normal immune function.

Table
Centers for Disease Control Classification System for HIV Disease

CDC System	Description Name	Common Name
Group I	Acute infection: Within one to two months of exposure "Mono"-like or central nervous system	Acute infection
Group II	Asymptomatic	Healthy carrier
Group III	Persistent generalized lymphadenopathy (PGL)	Lymphadenopathy
Group IV	A. Constitutional symptoms: fever, weight loss, diarrhea	ARC or wasting syndrome
	B. Neurologic disease	ARC
	C. Secondary infections:	
	C-1. CDC-AIDS infections	AIDS
	C-2. Other specified infections: thrush, zoster, tuberculosis, hairy leukoplakia, nocardia, recurrent salmonella bacteremia	ARC
	D. Secondary cancers: CDC-AIDS tumors: Kaposi's sarcoma, certain lymphomas	AIDS
	E. Other conditions: infections, cancers or symptoms not in A through D	ARC

The term ARC (AIDS-related complex) unfortunately has no generally agreed upon definition. Some use the term for any clinical manifestation of HIV infection short of full-blown AIDS. I prefer to limit that term to those with severe symptoms, prodromal infections, or severe immune deficiency as manifested by T-helper cell counts under 200/mm^3. The term "wasting syndrome" applies to patients with severe fever, weight loss, and diarrhea, which inevitably leads to AIDS (CDC group IV-A).

Certain infections, especially if recurrent, should raise the suspicion of HIV infection (CDC group IV, C-2). These infections have been called "prodromal infections" because they seem to carry a relatively high risk of progression to full-blown AIDS. This risk may be as high as 50% to 80% over the next one to two years. Prodromal infections include: 1) thrush, especially that which occurs in adults not receiving antibiotics or that which recurs after treatment; 2) zoster; 3) tuberculosis; 4) oral hairy leukoplakia, a condition resembling thrush which causes ribbed, white lesions on the lateral tongue margins or opposing cheek and is KOH-negative; 5) recurrent salmonella bacteremia; and 6) nocardiosis. The latter two are much rarer. In contrast to the onset of opportunistic infections, which is usually preceded by some warning sign such as the wasting syndrome or thrush, some individuals who develop Kaposi's sarcoma are often asymptomatic and simply notice the skin lesion. Many of them have had lymphadenopathy.

Tuberculosis itself—ie, infection with *Mycobacterium tuberculosis* (not to be confused with infection due to the atypical mycobacterium, *Mycobacterium avium-intracellulare*, which is common in full-blown AIDS)—is much more frequent among

HIV-infected people. It may occur either before or after the development of full-blown AIDS. Persons who were tuberculin-positive prior to the onset of HIV infection are very likely to develop active tuberculosis as immune function declines. Since there is a higher incidence of tuberculin positivity among urban intravenous drug abusers and foreign-born persons such as Haitians, one sees a concentration of HIV-associated tuberculosis in New York City, Newark, and Miami, and such can be anticipated in Detroit as our intravenous drug abuser HIV-infection rate climbs. Tuberculosis represents the one possible public health threat of HIV infection that is airborne. Fortunately, the tuberculosis seen is usually of low or no contagiousness since cavitary disease is very rare. The pulmonary manifestations are usually atypical of adult reactivation disease: for example, hilar lymphadenopathy and infiltrates typical of primary disease (even though not primary) or miliary disease. Often the tuberculosis is extrapulmonary involving lymph nodes only.

The four major neurologic manifestations of HIV infection are: 1) encephalopathy, of which the most common form is chronic and known as AIDS dementia which affects 50% of persons with full-blown AIDS; 2) myelopathy with ataxia and incontinence; 3) aseptic meningitis which may be chronic and recurrent; and 4) peripheral neuropathies including acute inflammatory polyneuropathies such as mononeuritis multiplex, distal symmetric neuropathies similar to those seen in diabetes, or cranial neuropathies (CDC group IV-B).

HIV-infected persons often suffer from an increased incidence of common skin disorders especially as immune function declines. These include seborrheic dermatitis (which often becomes very severe on the face in full-blown AIDS), folliculitis, furunculosis, acne, dry skin, dermatomycoses, and nonspecific rashes. These skin disorders tend to be stubborn and recurrent in HIV-infected persons.

Phenomena of immune dysregulation in HIV infection include frequent adverse drug reactions, blood cell dyscrasias (thrombocytopenia, leukopenia, and anemia), circulating immune complexes, and lupus-like abnormalities (lupus anticoagulant, antinuclear antibodies). In fact, almost any disorder could be a manifestation of HIV infection. Thus, we can now say of HIV infection what was once said of syphilis: to know AIDS is to know medicine.

The diagnosis of AIDS itself is made when a person is diagnosed as having one of the 12 opportunistic infections (CDC group IV, C-1), two tumors (CDC group IV-D), or lymphoid interstitial pneumonia in an infant (CDC group IV, C-1). These are the official CDC criteria for AIDS. Plans are to add to these criteria the wasting syndrome, AIDS dementia, and, in infants, certain combinations of severe bacterial infections. It is important to reserve the term AIDS for persons meeting these criteria since only these individuals have a prognosis that is inevitably fatal.

Tumors named in the criteria for full-blown AIDS include not only Kaposi's sarcoma and primary CNS lymphoma, but also non-Hodgkin's lymphomas of high-grade B-cell types if a patient is seropositive. These are usually histopathologically described as either diffuse undifferentiated, large cell, Burkitt's or Burkitt's-like lymphoma, or immunoblastic sarcoma. The recognition of AIDS-associated lymphomas means HIV testing should be performed on most persons with such tumor types. Knowledge of HIV infection is critical regarding management of the tumor and prevention of transmission, especially to sexual partners. At present, HIV lymphomas tend to be very aggressive, and the patient will die of other manifestations of AIDS if not the tumor itself. Therefore, the "no-treatment option" must be offered. An extremely high incidence of opportunistic infection must be anticipated whether or not treatment is given.

It is important to do HIV-testing on all patients with Kaposi's sarcoma, even if they are elderly men of Jewish or Mediterranean extraction. One of the most interesting aspects of AIDS is that the incidence of Kaposi's sarcoma is much higher in gay men (20% to 40%) than in any other risk group (2% to 10%) or even in Africans (16%). The manifestations of AIDS otherwise seem very similar in all risk groups. Hypotheses for this difference in the incidence of Kaposi's sarcoma involve two possible cofactors for Kaposi's sarcoma among gay men: the higher use of inhaled nitrites, and the higher incidence of reexposure to cytomegalovirus via semen among gay men.

Serologic Testing

Of all people infected with HIV in the United States, at present only about 1% to 2% have full-blown AIDS. Only one-third of all those infected have some symptoms, signs such as obvious lymphadenopathy, or laboratory abnormalities such as leukopenia or thrombocytopenia. The remaining two-thirds are asymptomatic and have no obvious abnormalities on physical examination or routine laboratory testing. The only way to detect these asymptomatic carriers is through serologic testing for antibodies to the AIDS virus. Two methods of HIV-antibody detection are commonly used. The screening test is done by the ELISA method, which is performed at Henry Ford Hospital and many other large laboratories. A preliminary estimate of the likelihood of a positive ELISA being a true positive can be made from how strong a positive it is. In our laboratory if the sample/cut-off ratio is greater than five, this is a strong positive and is very likely to be a true positive. The Western blot method of antibody detection is used as the backup or "confirmatory" test. The Western blot is much more difficult and expensive and is done only by a few reference laboratories. In Michigan it is done by the Michigan Department of Public Health in Lansing, and results take four to six weeks. The ELISA and Western blot can be thought of as roughly similar to the VDRL and the specific treponemal tests (such as FTA) for syphilis testing. However, the sensitivity and specificity of the ELISA is much higher than that of the VDRL, ranging from 95% to 99%.

The blood test for HIV antibodies is unlike any other test that a physician orders. This test should never be ordered without the patient's consent, except under the most extreme circumstances, because a positive result is a catastrophic event in the person's life. It is more devastating than a test for cancer or any other potentially fatal disease because no other disease carries the stigma that HIV infection carries. Persons have committed suicide as a result of this test, and any patient faces potential abandonment by family, friends, lover, as well as loss of job and insurance. It is absolutely essential that the physician determines the patient's

psychological support system before ordering the test. If the patient says there is no one with whom he or she can discuss the test result—ie, no family, friend, pastor, volunteer support group, or professional counselor—it is best to defer testing until support is available. In the meantime the patient is advised to behave as if he or she is positive. Before testing, all patients must be counseled about the limitation of antibody methods: 1) false-positives and false-negatives; 2) that even though the presence of antibodies does not prove that the infectious agent is present, it must be assumed that any antibody-positive person is presently carrying HIV; and 3) that antibody positivity gives no information about the duration of infection or prognosis. The patient must be counseled about the civil rights issues, particularly regarding homosexuality. Most heterosexuals are unaware that in Michigan homosexuals can lose their jobs and be refused housing just because they are homosexual. Although it is illegal to discriminate on the basis of race, sex, or religion, discrimination based on sexual preference is not illegal except in three cities in Michigan (Detroit, Ann Arbor, and East Lansing), which have local ordinances prohibiting such discrimination. Thus, known homosexuals can be fired whether or not they are HIV-positive. Moreover, since medical confidentiality is at best a loose term, a person known to his/her friends or co-workers as antibody-positive may become an instant leper. Some protection is offered in that the Michigan Department of Civil Rights has declared HIV infection a handicap. Nevertheless, attempts have been made to fire or refuse employment to HIV-positive persons. Because of these concerns, patients should be made aware that a number of alternate test sites offer anonymous testing. Patients may call Wellness Networks, our local AIDS organization, to obtain the locations. The Wellness Networks telephone number is toll-free (1-800-872-AIDS) throughout Michigan. At the alternate test sites, pretest and posttest counseling is given, the results do not go into the patients' medical records, and results are not given until the Western blot test result is received. Anonymous screening is often the best option for persons concerned about confidentiality, including heterosexuals at a low risk of HIV disease. For the latter, a positive ELISA test is usually going to be a false-positive. With anonymous testing the false-positive ELISA does not become part of the patient's permanent medical record (and thus a subject of misinterpretation indefinitely).

The predictive value of a test, that is, the likelihood that a positive is a true positive and a negative is a true negative, is a particularly critical issue regarding HIV testing. The formula used to calculate predictive value (Bayes' theorem) contains a critical third variable in addition to the sensitivity and specificity of the test. The critical third variable is the estimated prevalence of the disease in the population being tested. There is no way around the fact that the predictive value of a positive test will be low in a low-risk group, no matter how good the test is. For this reason screening of low-risk people on a large scale is not generally recommended unless they are going to be donating body parts to other individuals. On the other hand, the predictive value of a positive result is very high in high-risk groups, but in those groups the predictive value of a negative is somewhat lower. In fact, it is best to suggest that persons who have been on the receiving end of anal semen from a known infected person assume that they are positive indefinitely even though their screening test may be negative.

Management of Seropositive Persons

What should we tell people whose test results (both ELISA and Western blot) seem to be truly seropositive? Experimental studies indicate that the majority of these people are still infected and will likely remain so for life. Moreover, the sensitivity of our current culturing and antigen-detection methods (all of which are experimental at present) is suspected to be rather low. Latently infected cells could start producing infectious virus at any time. Thus, we have to assume that anyone who has ever been infected is still infected. No one knows why some persons will develop the fatal disease while others do not. In terms of predicting the likelihood of development of AIDS, time appears to be a major factor. The longer a person has had the infection, the greater the risk they will progress to full-blown AIDS. Certain prodromal infections such as thrush, zoster, and tuberculosis indicate a higher risk of progression. The single laboratory parameter that most closely correlates with the risk of AIDS is the absolute number of T-helper cells. The T-helper (or T4) lymphocyte is the key cell in the immune system. Normal numbers are 400 to 1700 per μL. Persons with less than 400 T-helper cells are at steadily increasing risk. Opportunistic infections become likely when the helper cell count reaches 200 or less, although some individuals can go a year or two at these levels without developing AIDS. On the other hand, Kaposi's sarcoma can develop with higher, occasionally even normal, numbers of T-helper cells. The T-helper-suppressor ratio appears not to be as important as the number of helper cells. However, there is some evidence that persons with very large numbers of suppressor (T8) lymphocytes (which results in a disproportionate lowering of the ratio) may be at greater risk. Usually full-blown AIDS does not develop without premonitory clinical or laboratory deterioration. If patients who are HIV-seropositive are followed, a progressive decline is seen in the number of T-helper cells in many of these individuals over a period of time, and the physician can then inform the patient when the risk of AIDS becomes significant. Knowing the T-helper cell count is clinically useful in other ways also: for example, a seropositive individual with cough and fever and 500 T-helper cells is very unlikely to have *Pneumocystis* pneumonia whereas someone with similar symptoms and 150 T-helper cells is very likely to have *Pneumocystis* pneumonia.

Another recently described predictive factor for high risk of AIDS over the succeeding one to two years is the appearance of circulating antigen to the core of the virus (p24 antigen) and disappearance of antibody to the core (p24 antibody). Assays for p24 antigen and antibody will soon be on the market.

Based on experience with other infections, certain conditions that contribute to a poor general state of health may make a person more susceptible to HIV. In addition, acceleration of HIV disease may result from repeated reexposure to other long-lasting viral infections such as cytomegalovirus, Epstein-Barr virus, and the viral hepatitides. In vitro, these viruses produce long-lasting activation of the T-helper cells, which makes these cells much more susceptible to infection with the HIV virus.

Persons with many sexual partners or repeated blood exposure have a much higher rate of reexposure to these ubiquitous viral agents. Certain proteins of these other viruses may "turn on" HIV. These proteins mimic the tat gene of HIV, which accelerates HIV replication.

Medical Management of Seropositive Persons

Seropositive individuals are seen for an initial evaluation. A history, physical examination, and the following tests are done: complete blood count with differential, sedimentation rate, platelets, and SMAC; urinalysis; helper/suppressor counts; skin tests for tuberculosis, histoplasmosis, coccidioidmycosis, and two controls; serology for toxoplasma, hepatitis B (including core antibody), herpes viruses (herpes simplex, cytomegalovirus, Epstein-Barr virus, and varicella-zoster), and syphilis (including VDRL and a treponemal test); and chest x-ray (particularly to rule out hilar adenopathy and tuberculosis). The skin tests and serologies serve to indicate infections to which a person may have been exposed in the past that can reactivate if the immune functions decline. These tests are more reliable if done when immune function is good. When immune function declines, most persons become anergic and antibody tests may become negative. Indicated vaccines and INH prophylaxis, if tuberculin positive, are offered. Follow-up is every six months if persons are feeling well and have normal numbers of T-helper cells; follow-up is every three months if persons are symptomatic or have low numbers of T-helper cells. At each visit a history and brief physical examination (with special attention to mouth, skin, lymph nodes, and spleen) are done. Laboratory studies include complete blood count with differential, sedimentation rate, and helper/suppressor counts.

Presently zidovudine (formerly known as AZT) is available to persons with ARC with less than 200 helper cells. This is another good reason for persons at risk to be tested and followed, since some persons with less than 200 helper cells are asymptomatic and may be passing up an opportunity for life-prolonging medication.

Advice to seropositive persons is as follows:

1. Maintain the best possible state of health. Get good nutrition, exercise, and adequate rest; reduce or eliminate drugs, cigarettes, and alcohol; and manage stress. Of these, stress management is often the most difficult. Persons who are seropositive without AIDS are actually under greater stress than persons with AIDS because of the uncertainty of their position. The feeling of carrying a time bomb is poorly tolerated by human beings. Many persons can benefit from professional counseling or volunteer support groups such as those run by Wellness Networks, Inc.

2. Use safe sex precautions. These precautions not only protect others but also the patient from acquisition of more HIV (which may not be helpful) and from reexposure to other viruses such as cytomegalovirus, herpes simplex, Epstein-Barr virus, and hepatitis B, which could accelerate the HIV process. Safe sex should be implemented even when both partners are seropositive.

3. Take indicated vaccines. These include vaccines for pneumococcus, influenza, hemophilus type B in children and hepatitis B for those individuals who are hepatitis-B-seronegative. Salk inactivated polio vaccine and diphtheria-tetanus toxoid are also safe. Live viral vaccines should be avoided: yellow fever, oral polio, and measles, mumps, and rubella. The only exception is asymptomatic seropositive children with normal immune functions who may do better with these live viral childhood vaccines, since to date no adverse complications have been reported.

4. Get regular checkups. This also enables the individual to be alert to the possible availability of antiviral or immune stimulant therapy in the future.

Prevention

The health care setting

Blood and body fluid precautions, the same as for hepatitis B, are recommended. This involves the use of gloves for drawing blood and touching mucous membranes or open sores. Gloves are all that are needed in most routine clinic visit settings. If there is a good possibility of aerosolization of blood, urine, feces, exudates, or respiratory secretion or saliva that contain observable (visible) amounts of blood, then full garb with mask, gown, gloves, and eye protection is indicated. These situations are likely during certain dental or endoscopy procedures, surgery, autopsies, and occasionally suctioning. If soiling of clothes with blood, exudates, urine, or feces is likely during examinations or nursing care, gowns are indicated. Many needle sticks are a result of recapping. Therefore, the most important measure in preventing needle sticks is the placement of impervious needle containers in every inpatient room and clinic examination room.

The AIDS virus is readily killed by all common disinfectants, most rapidly by chlorine. It is likely that even soap and water effectively inactivate the virus with regard to transmission potential, ie, reduce the amount of virus to such low levels that transmission is not possible. No evidence suggests transmission from environmental surfaces. Although all viral particles do not die immediately on exposure to air (the titer decreases about 1 log every nine hours and the usual amount of virus in body fluids is $\leq$ 1 to 2 logs), there is too little virus present on environmental services to be effectively transmitted. Often quoted laboratory studies which show prolonged survival of the virus on environmental surfaces are unrealistic, since the amount of virus used was much larger (eg, 7 logs) than that found in nature. If blood splashes on a person, the most important action is to wash it off promptly. What is used to wash it off is not critical. If blood splashes in the eye, the eye should be rinsed with copious amounts of water.

The aim of the Michigan Society for Infection Control and the Michigan State Medical Society Task Force on AIDS education is to get health care providers to gradually phase into "Universal Blood Precautions." This means the use of such precautions for *all* patients regardless of whether they are known carriers of HIV or hepatitis B. Any other policy is unrealistic if we are trying to prevent as many blood-borne infections as possible. The approach of testing all hospital admissions or clinic patients for HIV (or hepatitis B) is a naive one, although such an approach is the desire of many physicians these days. This approach ignores

several important realities: 1) testing misses some HIV-infected persons, especially within the first one to three months after infection (and physicians are also poor at guessing which patients are likely to be in high-risk groups); 2) HIV testing of all hospital admissions would be very costly (the estimate for Michigan alone is $35 million per year); 3) it is extremely likely that there are other serious blood-borne infections of which we are not yet aware; and 4) testing frequently leads to situations where health care workers are overly cautious with certain patients and careless with other patients—in other words, testing can lead to a false sense of security. It is much better to tighten up technique overall and to have a healthy respect for all blood and body fluids. Any other approach is naive and unrealistic.

Home precautions

Good hygiene is the principle precautionary measure. Items that might draw blood (eg, razor, toothbrush, nail clippers, enema equipment) should not be shared. Spills of blood and body fluid should be cleaned up promptly. A one-tenth solution of household bleach or other disinfectant such as Lysol is most effective. Disposable gloves are desirable for handling blood and body waste. If gloves are unavailable, emphasis should be on washing hands promptly if they become contaminated. In general, dishes and clothes can be washed in hot soapy water; bleach is not necessary. Household members should be informed of the results of studies on household transmission: none of 715 household members were infected, even when no special precautions were used. This indicates an extremely low risk of household transmission.

Intravenous drug abuse

We need many more drug treatment facilities, since waiting lists for drug programs are weeks to months. If persons cannot stop using drugs, they should not share needles or other "works" (such as "cookers"). If they cannot stop sharing "works," they should be taught to clean them with alcohol or a 1:10 dilution of household bleach. Intensive public information campaigns should be addressed to the sexual partners of drug users, promoting use of condoms and avoidance of pregnancy if one has a seropositive partner.

Sexual precautions

The following are our current best guesses as to the risk of each sexual activity:

1. 100% safe: 1) self-masturbation, and 2) mutually monogamous relationship since 1977 with partner who is not infected.

2. Probably safe: 1) Mutual masturbation (if no open sores on hands or genitals; if so, use disposable gloves), and 2) kissing of non-oral, non-anogenital areas of body (ie, kissing erogenous zone where there is intact skin such as ears, neck, breasts, etc).

3. Possibly safe: sexual kissing (ie, tongue-to-tongue kissing).

4. Very low risk: 1) fellatio with condoms, and 2) cunnilingus using dental dam (a piece of rubber that is held over the vulva, an activity which most persons find very awkward).

5. Low risk: 1) vaginal or anal coitus using condom and nonoxynol-9-containing spermicide (as backup in case of condom breakage), 2) fellatio without ejaculation, and 3) cunnilingus.

6. Low-intermediate risk: fellatio with ejaculation and without condom.

7. High risk: Unprotected vaginal or anal coitus.

No transmission has yet been documented from sexual kissing. Nevertheless, some concern remains especially for long-term heavy exposure as occasionally there may be small amounts of blood in saliva. Couples where one partner is infected can be counseled to minimize tongue-to-tongue kissing and spend more time kissing erogenous zones where there is intact skin.

HIV does not pass through latex condoms (natural skin condoms may occasionally leak). Ideally, condoms should be 100% protective. In actuality the failure rate with condom use for pregnancy is about 10% per year and is probably of similar magnitude for HIV. The reasons for failure are mechanical. Patients must be educated to condom use so these errors can be avoided. If meticulously used, condoms should be extremely protective.

The reasons for condom failure include the following:

1. Failure to use condoms properly (eg, not putting them on until just before ejaculation, their coming off due to failure to hold them on during withdrawal, or failure to withdraw before erection subsides).

2. Breakage (due to poor quality, deterioration from heat and age or use of oil-based lubricant such as Vaseline; attempts to reuse same condom; failure to eliminate air pockets under condom after putting it on; or failure to allow a space at the tip for ejaculation).

3. Failure to use them on all occasions.

The spermicide nonoxynol-9 kills HIV and many other sexually transmitted pathogens in the test tube. It is the main ingredient in most over-the-counter contraceptive foams, creams, and suppositories marketed for women and in some lubricants now being marketed for gay men. Concentrations of 1% should be adequate. Use of the spermicide provides some backup in case of condom failure. Some condoms are coated on the outside with spermicide, but it is advisable to use more spermicide. Spermicide should be inserted in generous amounts in the vagina or anus. A small amount of spermicide should be placed in the tip of the condom: enough to spread over the penile head but not so much that it oozes up the penile shaft causing the condom to slip off. The presence of spermicide on the inside of the condom tip has been shown to offer additional protection in case of condom breakage.

Physicians must strongly encourage celibacy or mutually monogamous relationships. Yet, at the same time, physicians must acknowledge the realities of sexuality, that most people in our society have at times had premarital, nonmarital, or extramarital sexual relations. Unless the physician feels that death is an appropriate punishment for such activities, the physician must help patients learn how to make sex safer. Society must work toward a mutual attitude that persons who have coitus outside of safe, mutually monogamous relationships without using condoms are regarded as careless persons who care little for their own health and less for the health of others. The biggest challenge is instilling this attitude in our young people, who traditionally see themselves as invulnerable and immortal. Condom ads on television may be distasteful to many people, but most people would find it more distasteful to see their children

or grandchildren get AIDS. The widespread use of condoms will have significant benefits in other areas, particularly in the reduction of other sexually transmitted diseases and unwanted pregnancies. Given the realities of human sexuality, the condom is our most important weapon in the fight against AIDS.

Additional Reading

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