

AIDS



What everyone should know about AIDS

General

The disease AIDS (acquired immune deficiency syndrome) is the end stage of an infectious disease caused by HIV (human immunodeficiency virus). A peculiarity of the HIV infection is that there is an interval of, on average, 12 years between the time of infection and the outbreak of the disease (= latency period). The cases of AIDS which we know of today comprise only a fraction of all those infected with HIV, and represent simply the status of the propagation of the infection a good decade ago. The large majority of HIV infected people will sooner or later develop AIDS unless, perhaps, the disease could be prevented from progressing, or even cured, by use of antiretroviral drugs.

Propagation of the HIV Infection

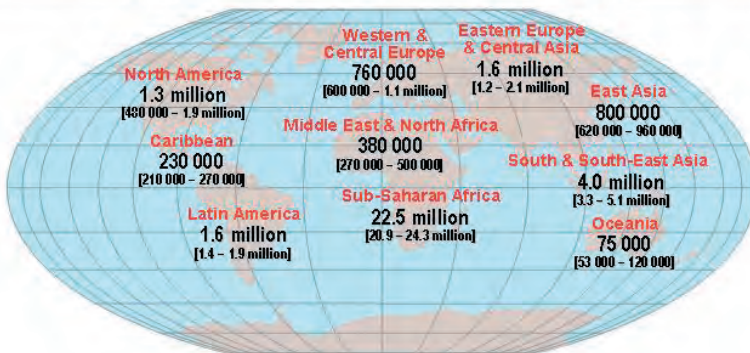
HIV initially spread undetected, by sexual transmission, in the sixties and seventies, first in Africa, then in the Americas and Europe, and finally in Asia. The disease AIDS was only discovered in 1981 in the USA – initially in homosexual men. At first, it was thought that only homosexuals were affected by this sexually transmitted disease. In the western industrial countries, however, even at that time the HIV

infection was spreading insidiously within the heterosexual population, too – starting from the so-called risk groups (homosexuals and drug addicts). In Africa and Asia, from the very beginning, just as many women as men were affected.

The World Health Organisation (WHO) estimates that by the end of 2007, throughout the world, 30.6–36.1 million persons still alive were carriers of HIV, 1.8–4.1 million of whom had become infected in 2007 alone: in other words 4932–11 233 new cases of infection per day. In the world as a whole, the HIV epidemic is still on the increase. In over 75% of cases worldwide the virus is transmitted through heterosexual contact.

In the industrialised countries the number of new cases of infection has increased since 2000. In Switzerland by the end of March 2009 there were 8845 cases of AIDS, and while 31 068 persons were recorded as infected with HIV, the number of undetected cases is assumed to be large. Already over half of those newly infected become so through heterosexual contact, although the incidence (i.e. percentage of HIV cases within a risk group) is 30 to 40 times higher among homosexuals and the drug-dependent than among heterosexuals.

Adults and children estimated to be living with HIV, 2007



Total: 33.2 (30.6 – 36.1) million

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From the Infection to the Disease

Pathogens

Two distinct types of AIDS virus are now known to exist: HIV-1 with 10 subtypes (A–J) and HIV-2 with 5 subtypes. There is also a series of strains that cannot be allocated to any category: e.g. Group O of HIV-1. Within each subtype and strain there are countless variants. HIV, like other viruses, is not an independent living organism. In order to survive and replicate, it relies on specific cells in the human body for „board and lodging“, so to speak. These are called host cells.

When a person becomes infected, the viruses invade the host cells, carrying with them an enzyme „reverse transcriptase“ which transforms the virus’s own genetic material (RNA) into human genetic material (DNA). The virus’s genetic material is then built into that of the host cell, where it can lie dormant for many years. When replicating, the virus misuses the host cell for its own purposes. Out of the newly formed virus parts, the enzyme protease builds infectious viruses, which leave the host cell and attack other cells. When the

genetic material is transformed and copies of genetic material are made for the production of new viruses, more and more new HIV variants emerge due to „translation mistakes“. These variants can differ in character from the original HIV, varying for example in infectivity and in the speed with which they lead to AIDS and to death. Several million virus variants have been observed to develop in just one person infected with HIV.

This mutability of HIV enables it to adapt to its surroundings, and is the reason why HIV may quickly become resistant to drugs and why attempts to develop either a vaccine, or drugs that could cure a person already infected with HIV, have so far been unsuccessful.

Weakening and destruction of the immune system

The immune system, has two main jobs: as well as combating outside invaders such as bacteria, viruses, fungi etc., which give rise to so-called infectious diseases, it also prevents cancer by tracking down and destroying the body’s own damaged or degenerate cells.

It takes several years before the human immune system is defeated. A veritable battle

goes on between the immune system and the viruses. We know now that as early as a few days after infection (during the acute infection stage) several thousand million (!) new viruses are formed. Even during the symptom-free latency period the viruses replicate with extraordinary vigour. The human immune system kills as many as are produced, maintaining equilibrium year upon year. When AIDS itself occurs in stage C, the immune system becomes exhausted and the quantity of virus steadily increases. The weakening of the immune system through HIV infection makes people increasingly vulnerable, especially to infectious diseases and cancer.

Macrophages, a Trojan horse

When viruses reach the human body's mucous membranes, as happens during sexual intercourse, they are first intercepted by so-called macrophages, which form, as it were, the front line in the body's defences, with the job of destroying pathogens (viruses, bacteria, fungi, parasites) the moment these enter the body. If successful at this stage, the macrophages alone may actually prevent infection from occurring. Their other job is to alert the immune system, should any pathogens get through the outer „cordon“ of defences. In the case of HIV, this otherwise effective alarm system fails, as HIV is able to hide and multiply inside the macrophage, impairing the latter's function. The virus uses the macrophage as a Trojan horse to get inside the body and propagate itself there.

Helper Cells are put out of Action

Once the HIV has reached the lymph nodes and the blood, it disables another line in the body's defences: the helper cells (CD4 Lymphocytes). These cells co-ordinate the combating of pathogens. Together with the macrophages they occupy a key position in the human defence system. Like the macrophages, the T4 lymphocytes are also „hood-winked“ by the HIV and used as host cells: they take in the virus, which can reproduce there and gradually suppress their function.

Antibodies

As happens in all infectious diseases, the immune system also develops antibodies,

according to the key and lock principle. These recognise the pathogens and help to destroy them. But because some HIV hides inside human cells, it cannot be detected and destroyed by the antibodies circulating in the blood. These antibodies, which are formed to com-

Detection of an Infection with HIV

The usual AIDS test, performed at the doctor's or at a medical laboratory, is the ELISA Screening Test to detect antibodies against HIV. The so-called Western Blot Test is a specific antibody test used to confirm or verify a positive ELISA test result. The interval between the initial infection and the appearance of antibodies in the blood (the seroconversion period) varies in length and depends on several factors (such as the route of transmission and the quantity of virus transmitted). As far as is known at present, HIV antibodies can be detected at the earliest 2 to 6 weeks after infection, but in most cases within 3 months. After exposure to risk it makes sense to wait 3 weeks before going for a test. If the result is negative, the test must be repeated after roughly 3 months.

There are two tests which detect the virus directly, rather than the antibodies: the antigen test, which can recognise a constituent of an HIV (p24 antigen), and the PCR (polymerase chain reaction), which identifies the virus's genetic material directly. The antigen test and the PCR are performed in addition to the ELISA antibody test to obtain a more reliable diagnosis if too few antibodies are present (in the first few weeks after possible infection) or if the test result is unclear. But, again, they fail to detect the virus from the first day after infection, doing so only a matter of days before the ELISA test, which is why these complicated tests are not routinely used.

The PCR test is also used to measure the number of viruses in the blood (viral load). This is of great importance in the treatment of HIV infection.

bat HIV, can be detected in laboratory tests, providing proof that a person has become infected with HIV.

Course of the Disease

Since 1993, HIV infection has generally been regarded as occurring in three stages and categories

Stage A comprises both the acute infection and the so-called symptom-free stage: within 2 to 6 weeks of becoming infected, the majority of HIV carriers experience a transient illness with high temperature, resembling glandular fever. There then follows the symptom-free stage, which can last for many years, throughout which the person infected experiences no sign of the disease. Throughout this period, however, the virus is replicating in the body and the victim can pass on the infection to others. Sometimes, over a period of several months, there is painless swelling of lymph nodes in the groin, armpits and neck.

Stage B comprises symptoms which, although resulting from advanced deficiency of the immune system, do not yet belong to the class of illnesses that define AIDS. Usually, these symptoms will already be accompanied by a severe deterioration in the patient's general condition, with persistent fever, nocturnal sweating, loss of weight and diarrhea. Various infectious diseases and rare forms of cancer occur. Particularly frequent are fungal diseases of the mouth (buccal cavity) and oesophagus due to *Candida*, or viral illnesses such as shingles.

Stage C signifies the end stage of the infection with HIV, the actual AIDS disease. This is caused by the collapse of the immune system and is marked by highly distinctive clinical pictures. Although the symptoms of the AIDS disease taken as a whole, are unmistakable, the individual symptom combinations may also occur in other diseases. A wide variety of infectious diseases and forms of cancer occur. Particularly frequent are fungal diseases of the oesophagus due to *Candida*, as well as special forms of pulmonary inflammation (*Pneumocystis Carinii* Pneumonia), atypical but also „ordinary“ tuberculosis, viral diseases (e.g.

CMV retinitis, a disease of the eye, caused by the cytomegalovirus); parasitic diseases (e.g. cerebral abscesses due to toxoplasmosis, diarrhea due to cryptosporidiae); rare tumours (e.g. Kaposi's sarcoma, lymph node sarcomas, and brain tumours), as well as neurological diseases (including HIV dementia) and drastic loss of weight (wasting syndrome). As well as identifying these clinical stages, the doctor can make use of specific laboratory tests which reveal in the blood the progressive deterioration of the immune system (decrease in T helper cells and increase in HIV in the blood), dividing the process into three laboratory categories (1, 2 and 3). As viral load increases, the T helper cell count falls, the immune system is progressively weakened, increasing the risk of opportunistic infections, i.e. illness due to otherwise harmless organisms which only appear if the immune system is seriously impaired.

Therapy

Antiviral Therapy

Currently, the classes of drugs available to combat HIV infection are the reverse transcriptase inhibitors and the protease inhibitors. These indirectly prevent the viral genome from becoming incorporated in the human host cell, by blocking an important enzyme for DNA synthesis – reverse transcriptase. The protease inhibitors block protease, a central enzyme responsible for forming new viruses. Nowadays these two classes of drug are used in combination. Both help to keep down the level of virus in the blood and lymph nodes and in this way slow down the disease's progress. Huge advances have been achieved in the treatment of HIV infection in the last few years. In the early nineties, antiviral therapy was used only in the advanced stages of HIV infection. Nowadays treatment is begun early in the hope: firstly of stopping further proliferation of the HIV virus and destruction of the immune system, thus halting the progress of the disease; secondly of suppressing the formation of resistant HIV variants; and thirdly of reducing proneness to infection. Studies have shown that in HIV positive pregnant women,

the risk of transmission of the virus to the baby can be greatly reduced by use of antiviral therapy.

Nowadays therapy is begun with two different reverse transcriptase inhibitors and one protease inhibitor. Reverse transcriptase inhibitors include AZT (Retrovir®), Lamivudin (3TC®), ddI (Videx®) or ddC (Hivid®). Protease inhibitors are Indinavir (Crixavan®) or Nelfinavir (Viracept®).

Pharmaceutical Prophylaxis for Patients with AIDS

Prophylaxis is aimed at preventing, or at least delaying the likely consequences of HIV in the AIDS stage. It only combats the symptoms and does not cure the HIV infection, nor is it a way of halting the destruction of the immune system.

The precise procedure for prophylaxis against opportunistic infections depends on the stage of the disease. Various drugs are used: e.g. Bactrim® for prophylaxis against *Pneumocystis Carinii* Pneumonia.

Post-exposure Prophylaxis (PEP)

For several years now, medical and nursing staff exposed to the risk of HIV infection by an injury at work – from a used syringe, for example – have been treated for two to four weeks with one or more anti-HIV drugs. This has reduced the risk of transmission by 80%.

Since 1997 this „treatment“ has been available in Switzerland also to persons who may have become infected through unprotected sexual contact with an HIV positive partner. But little is known at present about the effectiveness of the „treatment“, except that it should be started as soon as possible, ideally within a few hours, but not later than 72 hours after the infection risk situation, otherwise the HIV will already have spread in the body. These drugs must be taken for two to four weeks and have strong side-effects. The decision to carry out PEP needs careful consideration by a doctor in a central hospital, as nothing is yet known about long-term damage through antiretroviral therapy on healthy individuals.

How HIV is Transmitted

HIV is only transmitted from HIV infected humans to other humans, but not as easily as the influenza virus or the tuberculosis bacillus, which can be passed to others through the air, by coughs or sneezes, for example (droplet infection). HIV infection can only occur if bodily fluid containing the virus comes into contact with mucous membranes or broken skin, or reaches the blood directly (cf. Macrophages as a Trojan horse). HIV cannot penetrate the stratum corneum, the skin's horny outer layer.

HIV is present in various body fluids. Blood, semen and vaginal secretions contain very large amounts of the virus. Smaller amounts have been identified in saliva, breast milk, tears and urine. But HIV has not been found in sweat.

Routes of Transmission

Sexual intercourse The HIV infection is primarily a sexually transmitted disease. Transmission occurs via the sperm, as well as the vaginal secretions. A single sexual act with an HIV infected person can suffice to become infected. The danger of infection can also not be excluded in oral sex and so-called „French kissing“ (deep kissing).

Drugs With the sharing of HIV-contaminated syringes and needles (syringe swapping) injecting drug addicts are particularly at risk.

Mother-child transmission An HIV positive mother can infect her baby during pregnancy, during the birth or during breastfeeding (via the milk). The incidence of infection is around some 20–30%; this can be markedly reduced by AZT therapy.

Blood transfusions and organ transplants In all industrialised countries blood and organ donors are tested for a possible HIV infection (in Switzerland since autumn 1985). The residual risk of failing to detect an infection in the donor is extremely low (in Switzerland it is estimated at approx. 1:500 000). In countries of the Third World (in particular in Africa and South America) blood preserves can often not be guaranteed to be free from the virus.

The field of medicine If the customary rules of hygiene are adhered to, the risk for medical

No Risk of Infection

- In everyday life: tram (streetcar), school, toilets etc.
- Skin contact: shaking hands or stroking, kissing on the cheek
- Sports: swimming, ball games
- Eating: in a restaurant
- Sexuality: there is no risk of infection in an amorous relationship where both partners remain true (provided that neither of the partners is exposed to non sexual infection risks)

It is naturally a precondition that the customary rules of hygiene are observed, and that no contact with open wounds occurs.

staff of becoming infected with HIV is very slight. In the case of the most common mode of transmission, needle-stick injuries, (piercing with the needle of a syringe used by an infected person), the risk is estimated at 0.3 % per incident.

Rare routes of transmission In addition to the aforementioned, routes of transmission there are also very rare routes which, though just as tragic, are of little significance epidemiologically. These include tattoos, bite wounds, transmission of the virus from an infected surgeon to a patient, and so on.

Ways to Protect against an HIV Infection

Since no protective inoculation (serum) or curative drugs will be available in the foreseeable future, prevention by means of the safest possible behaviour is of decisive importance.

- Faithfulness In a faithful love relationship between two non-infected partners an infection with HIV is excluded.
- Careful choice of partners Today, the risk of an HIV infection is present in any new sexual relationship. For this reason it is particularly important to choose one's partner with great care. Only if the partner is not infected is transmission completely excluded. The fewer sexual partners one has, the lower the risk of becoming infected.

- HIV test If one of the two partners could have become infected with HIV at an earlier date, an infection could, with virtual certainty, be excluded or confirmed by means of an HIV test (see 'Detection of an HIV infection').
- Condom if a sexual partner is HIV-infected, the use of a condom can reduce, but not completely exclude, the risk of HIV transmission. In view of the fatal nature of the disease AIDS, even with state-controlled condoms there remains a non-negligible residual risk factor of several percent. Young people in particular often have little or no experience with condoms, so that the danger of incorrect application is considerable.
- Abstinence from drugs Drugs and alcohol dull the consciousness of reality and responsibility, as well as weakening one's powers of judgement and self-control, thus leading to overhasty and, frequently, unprotected sexual contacts. Abstinence from drugs is, therefore, an important factor in AIDS prevention.

On getting to know a new partner: careful choice of partner, the HIV test and condoms are the three measures with which one can exclude or reduce the risk of HIV infection. Combined they are all the more effective.

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