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Past Present and Future Status of HIV-AIDS Pandemic Problem in World

Narendra K Chopra*, Han Ni and Vichard Lim

Faculty of Medicine SEGI University, Clinical Campus, Hospital Sibu, (Sarawak State), Malaysia.

***Correspondence:**
Narendra K Chopra, Faculty of Medicine SEGI University, Clinical Campus, Hospital Sibu, (Sarawak State), Malaysia.

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ABSTRACT

The origin of human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) has puzzled scientists ever since the illness first came to light in early 1980s. The first recognized case of AIDS occurred in USA in 1981. For over 25 years it has been the subject of fierce debate and cause of countless arguments. It is now generally accepted that HIV is a descendent of simian immunodeficiency virus and there are many theories about how these "Zoonosis" originated and how SIV became HIV in human. Advances in anti retroviral treatment have steadily reduced the morbidity and mortality associated with HIV infection. However in the low-income, high- prevalence countries, antiretroviral medication has taken a long time to reach the people who actually need it. Access to medication must greatly improve if millions of deaths are to be avoided. HIV is preventable and controllable disease with integrated primary health care approach and with chain of strong effective surveillance system. Unless great progress is made in prevention, the number of people living with HIV will outstrip the resources available for treatment. As per data from UNAIDS summary of global epidemic 2017, total 36.9 million people are living with HIV, 1.8 millions are newly HIV infected adults & 1.8 million are infected children less than 15 years. The impact of control of HIV depends on vital epidemiological parameters like Child prevalence & incidence and annual new cases of HIV in adults & children, deaths due to AIDS in adults &children. The latest data of HIV/AIDS in adults, children male female & deaths as per WHO/ UNAID will be presented & discuss.

The search for effective vaccines & microbicides must therefore be one of very highest priority. HIV is global threat and action needs to be taken to prevent it killing many more millions than those who already have died. This action needs not only to continue but to be speeded up considerably.

Keywords

Acquired immunodeficiency syndrome (AIDS), Human immunodeficiency virus (HIV).

Introduction

Scientists believe that HIV originally came from a virus particular to chimpanzees in West Africa during 1930s, and originally transmitted to human through the transfer of blood through hunting. Over the decades, the virus spread through Africa and to the other parts of world. When acquired immune deficiency syndrome (AIDS) first emerged, no one foresaw how the epidemic would spread across the world and how it would change many millions of lives. There was no of real idea of what caused it and, consequently, no real idea of how to protect against it. Human immunodeficiency virus (HIV) has devastated families, communities and whole continents. We have seen the epidemic set back the development of countries by many decades, widen the gulf between rich and poor nations, and push already stigmatized groups closer to the margins of society.

The origin of HIV and AIDS has puzzled scientists ever since the illness first came to light in early 1980s. For over 35 years it has been subject of fierce debate and cause of countless arguments. In the US, reporting high rates of the rare forms of pneumonia and cancer in young gay man begins. The disease is initially called Gay- Related immune Deficiency (GRID) because it is thought it only affects gay men. Cases are also reported in Injection Drug Users by the end of the year.

The first recognized case of AIDS occurred in the USA in 1981.

A number of gay men in New York and San Francisco suddenly began to develop rare opportunistic infections and cancers that were resistant to any treatment. It is quickly become obvious that all the men were suffering from a common syndrome. The discovery of HIV was made 2 years later.

HIV is a lentivirus and, like all viruses of this type, it attacks the immune system. Lentiviruses are part of a larger group of viruses known as retroviruses. They have been found in a number of different animals including cats, sheep, horses and cattle.

However, as far as the origin of HIV is concerned, the most interesting lentivirus is the simian immunodeficiency (SIV) that affects monkeys. Although HIV came to light in the early 1980s, there is evidence that HIV infection was prevalent much earlier. The earliest known instances of HIV infection are as follows:

- A plasma sample taken in 1959 from an adult male living in Democratic Republic of Congo has been found positive for HIV.
- HIV has been found in tissue samples from an American teenager who died in St Louis in 1969.
- HIV has been found in tissue samples from Norwegian sailor who died around 1976.

A 1998 analysis of plasma sample from 1959 has suggested that HIV-1 was introduced into humans sometime in 1940s or early 1950s [1] much earlier than previously believed. Other scientists have dated the sample to even earlier period- perhaps as far back as the end of 19th century. In January 2000, the results of study carried out by Dr Bette Korber of Los Alamos National Laboratory (which was presented at 7th Conference on Retroviruses and Opportunistic Infections) suggested that that the first case of HIV-1 infection occurred around 1930 in West Africa.

It is now generally accepted that HIV is a descendant of an SIV because certain strains of SIV bear a very close resemblance to HIV-1 and HIV-2. HIV-1 corresponds to strain of SIV found in chimpanzees [2,3] and HIV-2 corresponds to a strain found in the sooty mangabey, which is indigenous to western Africa [4]. Viral transfer between animals and humans known as zoonosis is well recognized. There are many theories as to how HIV could have crossed species.

The 'Hunter' Theory

According to the hunter theory, SIV was transferred to humans when hunters ate the flesh of infected Chimps or when the blood of chimpanzee contaminated cuts or wounds on the body of hunter. The fact that there were several different early strains of HIV, each with slightly different genetic makeup, would support this theory, every time the virus was passed from a chimpanzee to a man; a slightly different strain was produced. Wolf et al. were able to show how retro viral transfer from primates to hunters still occurs [5].

The oral polio vaccine (opv) theory

In the late 1950s, an oral polio vaccine called CHAT was tested on about a million people in the Congo, Ruanda, and Urundi. Kidney cells from local chimps were used to produce this live polio vaccine. In his book, The River, Edward Hooper suggested that the origin of HIV could be traced to the testing of the CHAT oral polio vaccine, which was grown in kidney cells from local chimps infected with SIV. This, he claims, would have resulted in the contamination of the vaccine which chimp SIV leading to a large number of people subsequently becoming infected with HIV-1. However, subsequent analysis of the vaccine in April 2001 showed no trace of either an HIV OR SIV [6].

A second analysis confirmed that only macaque monkey kidney cells, which cannot be infected with SIV OR HIV, were used to make CHAT [7]. The fact that HIV probably existed in humans before the 1950s also suggests that the OPV theory is not tenable as the sole method of transmission.

The Colonialism Theory

An American specialist in primate behavior, Jim Moore, first proposed this theory in 2000 [8]. During the late 19th and early 20th century, much of Africa, including French Equatorial Africa and Belgian Congo, were ruled by colonial forces. The labour camps were overcrowded, sanitation was poor, and physical demands on the inmates were extreme, all of which would have weakened the immune system of camp immates, paving the way for SIV to become HIV. Practices such as use of unsterile needles to inoculate laborers against diseases such as small pox and employing prostitutes to keep the workers 'happy' would have created numerous opportunities for transmission. The fact that these labour camps were set up at around the same time that HIV is first believed to have passed into humans- the early part of 20th century- provides support for this theory.

The Conspiracy Theory

A significant number of African Americans believe HIV was created as part of biological warfare programme that was designed to wipe designed to wipe out large numbers of black and homosexual people [9]. Some believe that HIV virus was spread worldwide through the smallpox inoculation programme or alternatively to gay men through hepatitis B vaccine trials.

The truth about the origin of HIV will continue to be debated for many more years. However, there is now clear evidence as how HIV spread to USA. In March 2007, at the 14th Conference on Retroviruses and Opportunistic Infections in Los Angeles, data was presented showing that HIV had probably brought to Haiti from Congo by a single infected person in around 1966 [10].

Genetic analysis showed that the virus had spread slowly from person to person on the island before being transported to the US, probably by single individual, at some point between 1969 and 1972. From this point on, the epidemic spread rapidly, with transmission occurring within and between the US and Haiti and also internationally.

The Contaminated Needle Theory

In developing countries, the practice of reusing syringes without

adequate sterilization to inject multiple patients could have led to a rapid transfer of viral particles between patients. This would have created a huge potential for the virus to mutate and replicate in each new individual, thereby enhancing the spread of HIV.

Thirty – Five Years of Hiv/Aids

1981: (March) At least eight cases of an aggressive form of Kaposi's sarcoma occurred amongst young gay men in New York [11]. At about the same time, both in California and New York, a number of cases of rare lung infection Pneumocystis carinii pneumonia (PCP) was also diagnosed [12]. Early theories regarding the cause of these outbreaks included infection with cytomegalovirus, the use of amyl nitrite or butyl nitrate 'poppers' an immune overload [13,14].

1982: The term acquired immune deficiency syndrome (AIDS) is first used.
1983: (May) Doctors at the Institute Pasteur in France reported that they had a isolated a new virus; they named it lymhadenopathy-associated virus or LAV [15].
1984: (April 23rd) Dr Robert Gallo of the National Cancer Institute, USA isolated the virus and named it HTLV-III.
1985: An HIV antibody test became available.
1986: (May) The International Committee on the Taxonomy of Viruses recommended that the terms LAV and HTLV-III be dropped and and a new name,Human immunodeficiency virus (HIV), be used [16].
1987: Zidovuidine (AZT), the first antiretroviral drug, got FDA approval [17].
1993: The Anglo- French clinical trial Concorde concluded that AZT was not effective in treating in asymptomatic HIV-positive patients [18].
1994: ACTG 076 showed AZT reduced mother-to child HIV transmission by two-thirds [18].
1995: The Delta trial and the ACTG175trial showed that combination of AZT with didanosine (ddI) were more effective than AZT alone in delaying disease progression and prolonging life. The first protease inhibitor, saquinavir, became available.
1996: Introduction of viral load test.
1997: For the first time, the number of deaths from AIDS dropped substantially across the developed countries.
2003: Fuzeon gained FDA approval. This was the first of new type of anti-HIV drug that was designed to prevent the entry of HIV into human cells.
2006: Two African trials of male circumcision as an HIV prevention method were halted early for ethical reasons because preliminary analysis showed that they reduced HIV transmission by around 50%.

Since the start of the HIV epidemic, a series of antiretroviral drugs have been developed which have significantly prolonged the lives of HIV –positive people. But there have been associated challenges such as the increase in pill burden, problem with adherence to treatment, drugs side effects, development of resistance, treatment failure and increase in cost of care.

There are currently five main classes of drugs, operating at different points in the HIV cycle:

- **Nucleoside reverse transcriptase inhibitors:** Disrupt the copying process by blocking the enzyme reverse transcriptase.
- **Non- Nucleoside reverse transcriptase inhibitors:** These drugs attach themselves to the enzyme, reverse transcriptase, which controls the copying process.
- **Protease inhibitors:** Acts by interrupting the assembly of the new virus particle.
- **Entry inhibitors:** Binds to the proteins on the outside of the HIV virus, preventing it from attaching itself to and entering a CD4+ cell.
- **Integrase inhibitor:** Prevents integration of viral RNA to cellular DNA.

The goal of HIV therapy is to reduce the viral load to undetectable levels (i.e below 50 copies/ml). This would help to restore immune function, reducing HIV- related morbidity and mortality and thus aid in achieving the ultimate goal of improving quality of life. Currently over 29 antiretroviral (ARV) agents are available and many more are in development stage.. Until recent times the side effects, both short and long term, have been a concern but the newer agents are addressing these issues. In the Highly active anti retroviral therapy (HAART) era, as the life expectancy of HIV-infected individuals continues to increase, cardiovascular disease, hepatic disease and malignancy have become important issues among this population.

In order to combat this, newer agents are being developed, with higher genetic barrier and better efficacy against resistant strains.

The key development in HIV care in high-income countries has been the elimination of mother-to- child transmission (MTCT) of HIV. This has been achieved by introducing effective voluntary testing and counseling, enabling access to ARV therapy, instituting safe delivery practices and by making available safe breast-milk substitutes. Even in resource- limited countries, a reduction in MTCT is seen with limited interventions.

It is very unlikely that HIV and AIDS will ever be eradicated without new scientific developments. For every person who starts treatment with ARV, another six become infected. Unless great progress is made in prevention, the number of people living with HIV will outstrip the resources available for treatment.

Current methods for preventing HIV infection are far from perfect. Education has been proved to be effective and necessary, both for people who are not infected with HIV and for those who are infected. Behavior therapy, condom use, voluntary HIV testing and treatment of sexually transmitted infections are proven methods of HIV prevention

In theory, if everyone abstained from sex or remained faithful to one partner and always used condoms and condoms alone nobody injected drugs, then HIV and AIDS might be controlled and eradicated. However, in real world behavior changes and condoms

alone will not eliminate the virus; they will only help to control its spread. A number of HIV prevention approaches are currently available or are in late stage of clinical trials.

Global Hiv Status as Per Unaids Report 2017

People Leaving with HIV

- In 2017, there were 369 million people leaving with HIV. - 35.1 million adults. - 1.8 million children under 15 years.
- 75% of all people living with HIV knew their HIV status.
- About 9.4 million people did not know that they were living with HIV.

People Living with HIV Accessing A.R.V Treatment

- In 2017, 21.7 million people living with HIV were assessing antiretroviral therapy, up from 8 million in 2010.
- 59% of all people living with HIV of children were accessing treatment.

- 59% of adults aged 15 years and above had access to treatment as did 52% of children aged 0 to 14 years.
- 65% of female adults aged 15 and above had access to treatment.
- 53% male adults aged 15 years and above had access to treatment.

- 80% of pregnant women living with HIV had access to antiretroviral medicines to prevent transmission of HIV to treat their babies in 2017.

New HIV Infections

- New HIV infections have been reduced by 47% since the peak in 1996

- In 2017, around 1.8 million were newly infected with HIV compared to 3.4 million in 1996.
- Since 2010, new HIV infections among adults have declined by estimated 16% from 1.9 millions to 1.6 million in 2017.
- Since 2010, new HIV infections among children have declined by 35% from 270,000 in 2010 to 180,000 in 2017.

AIDS Related Deaths

- AIDS-related deaths have been reduced by more than 51% since the peak in 2014.
- In 2017, around 940,000 people died from AIDS-related illness.

Worldwide, compared to 1.9 million in 2004 and 1.4 million in 2010

90 – 90- 90 Target

- In 2017, three out of four people living with HIV (75%) knew their status.
- Among people who knew their status, 4 out of five (80%) were accessing treatment.
- Among people accessing treatment, 4 out of five (80%) was virtually suppressed.
- 47% of all people living with HIV are virtually suppressed.

Women

- Every week around 7000 young women aged 15 to 24 years become infected with HIV.
- More than one third (35%) of women who experience violence are one and half times more likely to become infected with HIV.

Key Populations

Key populations and their sexual partners account for:

- 47% of new HIV infect globally.
- 95% of new HIV infection in Eastern Europe and central Asia and Middle East and north Africa.
- 16% of new HIV infection in Eastern and Southern Africa.

The risk of acquiring HIV infection is

- 27 times higher among men who have sex with men.
- 23 times higher among people who inject drugs.
- 13 times higher for female sex workers.
- 13 times higher for transgender woman.

HIV/ Tuberculosis (T.B)

- TB remain the leading cause of death among people living with HIV accounting for around one in three AIDS – related deaths.
- In 2016, 10.4 million people developed TB disease; 1.2 million were living with HIV.
- It is estimated that 49% of people living with HIV and tuberculosis are unaware of their co-together and are therefore not receiving care.
- Therefore every tuberculosis patient must be screened for HIV test and every HIV patient must be screened for Mantoux test & sputum for AFB.

Male Circumcision

Since 1980s, scientists have suspected that male circumcision might reduce the chances of HIV transmission during sex. Circumcised men are less likely to have HIV than uncircumcised men, and countries with higher rate of male circumcision have lower rates of HIV infection. Removal of HIV target cells from foreskin, keratinization of skin surface, and reduction of Sexually Transmitted infections (STIs) are key factors through which circumcision exerts its protective effect [20,21]. We now have conclusive evidence from studies in Africa that male circumcision, if performed safely in medical environment, brings about a 65% reduction in the risk of man becoming infected with HIV through heterosexual sex.

Microbicides

A microbicide is a chemical product applied in the vagina to inactivate HIV. Anal application is also been studied. They act as a physical barrier, maintain vaginal flora, and prevent STIs. A number of second- generation microbicide candidate, including tenofovir- containing microbicides, are in the early stages of research. Nine HIV microbicide trials were in progress at the start of February [22].

Three microbicide candidates are undergoing phase III trial to test their effectiveness; these are:

- Buffer Gel, which maintains acidity in the vagina.
- Carr guard, an entry inhibitor based on carrageenan, which is

derived from seaweed.
- PRO 2000, another entry inhibitor.

In August 2006, Family Health International decided to halt a phase III trial of Surfactant called SAVVY after preliminary results showed no evidence of protective effect [23]. Two phase III trial of an entry inhibitor called cellulose sulphate were halted in January 2007 after some sites recorded a higher HIV infection rate among women who used the gel compared to those in the placebo group. It is not yet known why cellulose sulphate was associated with an increased risk of infection; this result was entirely unexpected [24].

Cervical Barrier

Cervical barriers such as diaphragm may help protect women from HIV and other STIs. An efficacy trial of diaphragm for HIV prevention had recently completed in South Africa and Zimbabwe.

Herpes Suppression

Genital herpes simplex infection significantly increases the risk of HIV acquisition as well as the risk of transmission to others [25,26]. Trials are being conducted in Africa and the US to test the effectiveness of suppression of herpes with acyclovir in lowering HIV risk.

Preexposure Prophylaxis with Anteretrovirals

Efficacy trial of truvada (Tenofovir and Emitricitabine) in preexposure prophylaxis is being conducted in Botswana, Thailand and Peru [27]. Proof of this concept derives from the use of ARV to prevent MTCT of HIV. A significant disadvantage of this approach could be the development of drug resistance.

HIV Vaccine

The aim of vaccination is to induce either neutralizing antibody or a T-cell response or both. Although the search for an effective vaccine has been continuing for more than 25 years, it has been continuing for more than 25 years, it has remained elusive. The genetic diversity of HIV; its ability to infect the cell of the immune system, to spread from cell to cell, and to integrate its genome into the host cell; and viral resistance are the main challenges in producing an effective vaccine, currently 30 HIV vaccine candidates are in clinical trials.

There is no 'magic bullet' for HIV prevention. None of the new methods being tested currently is likely to be 100% effective in prevention and all will need to be used in combination with existing approaches. However, even a partially effective vaccine or microbicide could save many millions of lives. Experts have calculated that a vaccine that is effective 50%, given to just 40% of the population could reduce the number of HIV infections in developing world by more than half over 10 to 12 years. Greater access to existing HIV prevention tools could avert half of new in infections projected to occur over next decade.

Future of HIV Care- The Next 20 Years

Including more people in HIV screening in clinics and primary care and other health care setting will result in a situation where very few patients infected with HIV will be unaware of their diagnosis. This would help in controlling HIV transmission as well as identifying HIV infection before advanced immunosupression has set in.

Increased awareness of HIV status; increase in condom use; increase in condom use; increase in use of female –initiated HIV prevention methods, such as use of microbicides of potency and cervical diaphragm and increase in male circumcision in high prevalence countries will all help to reduce sexual transmission of HIV.

Health manpower shortage and inadequate infrastructure will result in limited HIV treatment programmers in resource- limited countries. In spite of this, most of those found to be infected will have access to care. Antiretroviral drugs will be more widely available and treatment will be extremely convenient. Evidence shows that treatment should be initiated at higher CD4 lymphocyte count than is currently practiced.

The availability of cheaper ARV drugs, increase in choice of drugs, less toxicity, higher genetic barrier, and convenience of treatment would result in all cases being treated. Antiretroviral drugs will also be widely used to prevent HIV transmission. MTCT will be gradually eliminated in high-income countries. Antiretroviral therapy will be continued after delivery, both to treat the mother's disease and to allow safe breast feeding.

The HIV pandemic remains the most serious infectious diseases challenge in public health. AIDS is a preventable disease. Every day over 7000 persons become infected with HIV and over 6000 dying from AIDS. Most deaths are the result of inadequate access to HIV prevention and treatment services [28]. People need empowerment to negotiate safe and responsible sexual relationships; gender inequalities must be confronted, and those who choose to have sex need access to condoms. Needle exchange programs should be encouraged, as they have proven to be highly effective in preventing HIV transmission among injecting drug users. The search of effective vaccines and microbicides must be one of very highest priorities in scientific research.

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