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Study of Pathogenesis and Therapeutics of HIV

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Abstract
HIV(Human Immunodeficiency Virus) is a significant global health challenge has led to the ongoing AIDS (Acquired Immunodeficiency Syndrome) epidemic. HIV primarily targets and weakens the immune system by infecting CD4 cells, T cells and macrophages, thereby reducing the body's ability to fight off infections and diseases. The virus is transmitted through the transfer of blood, breast milk, semen and vaginal secretions, HIV infection progresses through various stages, starting with acute infection, followed by clinical latency, and eventually leading to AIDS if untreated. While there is no cure for HIV, antiretroviral therapy (ART) has proven effective in managing the virus, prolonging the lives if those infected, and reducing the risk of transmission. Preventative measures, such as condom use and safe blood transfusion practices, play a crucial ole in mitigating the spread of HIV. Despite extensive research, no vaccine is currently available to prevent HIV infection. Continued efforts in education, prevention, and treatment are essential to combating this pervasive virus and improving the quality of life for those affected.
Keywords: *HIV, health effect, AIDS, sexually transmitted disease, reverse transcriptase*

I. Introduction

"Human Immunodeficiency Virus" or HIV is transmitted through blood transfusion, semen transmission and vaginal fluid transmission. HIV virus is responsible for spreading AIDS in human. The immune system of the human body is designed in such a way that it can get protected from both bacterial and viral infection. White blood cells of the immune system that contain the CD4+ also known as helper T cells decreases in count [1]. The pathogenic test of HIV is very crucial so we need some strategy for continous revision according to the mechanism of infection [2]. There are generally two types of HIV virus are HIV-1 and HIV-2.The main agent of AIDS is HIV [3]. HIV virus belongs to the retroviridae family. The genomic structure of the HIV -1and HIV -2 are same but they differ in their genome [3]. Structure of HIV-1 and HIV-2 are same but differ in their gnomic structure. The virus usually omits the central nervous system. Both HIV-1 and HIV-2 causes AIDS [4]. HIV-2 is less virulent in comparison to HIV-1 and takes progress to AIDS [5]. Several health problem arises due to the death of a person [6]. 37 years ago HIV was first reported in the United States. 35 million deaths occur due to interaction among 77 million people. 36.9 million of people are infected with this virus, 1.8 million are newly infected, 1 million are facing annually [7]. AIDS can be cured after proper medication. Antiretroviral are the most impressive research in the treatment of this disease [8]. If a person gets infected with this virus in their early 20s and e is treated with Antiretroviral drugs, then there is a possibility of him living for more than 50 years with suppression of the viral replication that can also lead to a healthy life [9].

II. Structure and composition of HIV Virus

a) Envelope: The spherical enveloped virus is around 90-120 nm in size. The nucleocapsid has an outer icosahedral shell and an inner cone-shaped core which encloses the ribonucleoprotein [10].
b) Genome: Two single stranded RNA copies can be converted and double stranded DNA can be integrated in host cell chromosomes. This provirus influences the function of host cell by remaining latent for a long period [11].
c) Lipoprotein envelope: During viral replication, the buds out virus acquires a lipoprotein envelope. The virus coding envelope proteins are knob-like spikes that remains on the surface which in turn achors the transmembrane pedicles. The spikes bind to the CD4 receptors on host cells. Trasmembrane pedicles occur by cell fusion [12].

3. Transmission of HIV Virus:

HIV virus transmitted generally by three possible ways: by sexual contact, by blood transfusion and from mother to her child. HIV can also be shared between two persons by sharing the needles [13,14,15,16]. In developing countries HIV spread through spread of the blood products [17]. HIV transmitted from infected mother to infected child during breastfeeding and feeded by the milk found by high levels of the virus. This

virus can also be carried out by the neonatal before their birth [18]. Person working in the health care sector are also injured by needle stick.

HIV can also be transmitted from person to person by healthy ones:
a) Sexual contact without protection.
b) Contaminated blood products i.e; by blood transfusion, sharing of same needle among drug users and also by some health care products.
c) Mother to baby (both before and during birth) [19].
d) Through body fluids such as Semen, blood, vaginal secretions, breast milk, preejaculatory fluid.
The concentration of HIV is high in semen, blood, vaginal secretions, breast milk, pre-ejaculatory fluids,pus, saliva, tears, urine, feces, vomiting and nasal mucosa [20].

III. Target Cells of HIV

T lymphocytes, macrophages, monocytes and dendritic cells are become targeted by HIV. The cells surface receptor need for the virus entry [21]. Primary receptor for HIV is CD4 found on T helper, monocytes, macrophages and DCs [22]. In addition to CD4 a co-receptor is necessary to fuse with target cells [23].

IV. Signs and Symptoms of HIV infection/AIDS

People with HIV infection are usually seen to show flu-like symptoms like fever, sore throat and fatigue. In HIV infected people yeast infections can also be seen. In infected people also there is a virus known as Herpes Zoster. The nervous system also attacked by the virus and produces symptoms like tingling in feet and trouble in walking to memory los[24].

Symptms usually include:

a) Frequent fevers
b) Swollen glands
c) Growth becomes slow in children
d) Cough and shortness in breath
e) Nausea
f) Cramps
g) Diarrhea
h) Vomiting
i) Weightloss

V. Life Cycle

The life cycle of HIV AIDS occurs in four steps. Entry to human cells, reverse transcription, transcription and translation, assembly budding and maturation [25].

HIV virus when take entry into the human body make copy of itself. The viruscontain CD4 cell that is protein in nature. HIV virus when sticks to the CD4 cells allow them to fuse. The virus mainly attacks the immune cells thereby weakening the immune system. Reverse transcriptase uses for running the enzyme reverse transcription [26]. Enzyme converts RNA into DNA. Enzyme integrase is there. These enzymes insert DNA inside the nucleus of the cell. HIV virus converts themselves into messenger RNA [27]. Large numbers of HIV gather inside the cell and made new HIV protein and enzyme. Viral particle gets separated from the original CD4 cell through a process called budding [28].Enzyme protease breakdown HIV protein into smaller particles and can target CD4 cells.

VI. Laboratory Diagnosis of HIV/AIDS

The most common method of diagnosis of HIV is by testing the blood and saliva sample of a person as the antibody to that virus remains present there. But the procedure takes quite longer time as the body takes around 12 weeks to produce these antibodies.
Tests that are performed for the detection of HIV/AIDS:
Home Test:
Food and Drug Administration is also known as approved test. From the upper and lower gums swab sample is taken. For the positive test further diagnosis is performed and for negative test repeated test were performed. The process is repeated after three months for the confirmation of the results.
Diagnosis of HIV/AIDS is performed by te following test:

a) CD4 Count: CD4 cells are targeted and destroyed by HIV virus during infection.
b) Viral Load: This test is performed to measure the presence of amount of virus in patients blood.
c) Drug resistance:

This test is performed to measure the presence of amount of drugs by the body that is provided during HIV infection.

d) HIV Immunoassay: In this technique, detection of HIV is done by targeting anti-HIV antibodies. HiV immunoassays are also called as "Generations"of test and wih each generation , improvement in performance is observed. There has been a recent development of highly sensitive HIV immunoassay which has the capability of discriminating HIV-1 and HIV-2 antibody. HIV-2 antibody and HIV-1 both shows p24 reactivity. This test has been made available internationally since 2015.

e) Nucleic acid tests: Nucleic acid amplification test (NAAT) is also used for the detection of HIV. Reverse transcription polymerase chain reaction (RT-PCR) and transcription mediated amplification (TMA) is used to detect HiVRNA or HiV DNA. HIV viral load is also observed by NAATs. Blood banks have been using NAATs for HIV treatment since 1990. And it is also used for screening donors before organ donation.

Treatment of HIV/AIDS

Nucleoside Analogue Reverse Transcriptase inhibitors (NARTIs) are the very first drug used for the treatment of HIV. In the year of 1987 it was first used. Non nucleoside reverse transcriptase inhibitors were also approved in the year of 1997.

The classification of antiretroviral drugs are as follows:

a) Nucleoside reverse transcriptase inhibitors are Zidovudine, Didanosine, Lamivudine, Tenofovir.

b) Nonnucleoside reverse transcriptase inhibitors: Nevirapine, Delaviridine, Elavirenz.

c) Protease inhibitors:
Indinavir, Nelfinavir, Amprenavir, Lopinavir, Atazanavir.
Another active antiretroviral therapy is HAART. Thiis drug is also used for the treatment of HIV infection.
There is no effective vaccine released yet for HIV infection. Although a vaccine composed of poxvirus have been made trial with but that provided only 30% protection.

VII. Health Impact Post-HIV Diagnosis

People infected with the HIV virus experience various adverse effects on their bodies after treatment. Individuals treated with antiretroviral therapy may face mild adverse effects, such as bloating, nausea, diarrheae, which can persist throughout the therapy. In addition to these, other possible adverse effects include hepatotoxicity, hyperglycemia, and misdistributions dyslipiemia etc.

VIII. Conclusion

HIV is a virus that primarily leads to AIDS. AIDS weakens the immune system. As it is a sexually transmitted infection, care an precautions should be taken during intimation by the couple. It has been reported that use of condoms reduces the chance of infection by less than 1%. Various screening test and drugs are used during the treatment of HIV infection. People are made aware for this infection through ICTC. There is no vaccine made available yet for the prevention of HIV. Proper protection and awareness can prevent the spread of HIV among people.

References:

[1]. Alkhatib, G., & Berger, E. A. (2007). HIV coreceptors: From discovery and designation to new paradigms and promise. European Journal of Medical Research, 12(9), 375-384.

[2]. Amborzia, J., & Levy, J.A. (1998). Epidemiology, natural history and pathogenesis of HIV infection. ln K. K. Holmes, P.F. Sparling, P.A. Mardh, S. M. Lemon, W. E. Stamm, P. Plot, & J.N. wasserheit (Eds.), Sexually transmitted diease (3rd ed., pp. 251-258).

[3]. Ananthanarayan, R. (2006). Ananthaarayan and Paniker's Textbook of Microbiology (pp.1-992). Orient Blackswan.

[4]. Broder, C. C., & Berger, E. A. (1995). Fusogenic selectivity of the envelope glycoprotein is a major determinant of human immunodeficiency virus type 1 tropism for CD4+ T-cell lines vs primary macropages. Proceedings of the National Academy of Sciences. 92(19), 9004-9008.

[5]. Carr. A., & Cooper, D.A. (2000). Adverse effects of antiretroviral therapy, Lancet, 356, 1423-1430.

[6]. Chopra. N.K., Ni. H., & Lim. V. (2019). Past, present and future status of HIV/AIDS pandemic problems in the world. Microbiology and Infectious Diseases, 3(1), 1-6.

[7]. Coffin, J. M. (1999). Molecular biology of HIV. In K. A. Crandall (Ed.), The evolution of HIV (pp. 3-40).

[8]. De Goede, A., Vulto, A., Osterhaus, A., & Gruters, R. (2014b). Understanding HIV infection`for the design of a therapeutic vaccine. Part I: Epidemiology and immunodeficiency virus type 1 tropism for CD4+ T-cell lines vs primary macrophages. Pharmaceutiques Francaises, 73(2), 87-99.

[9]. Downs, A. M., & De Vincenzi, I. (1996). Probability of heterosexual transmission of HIV: Relatonship to the number of unprotected sexual contacts. European Study Group in Heterosexual Transmission of HIV. Journal of Acquired Immune Deficiency Syndromes and Human Retrovirology, 11(4), 388-395.

[10]. Emerman, M., & Malim, M, H. (1998). HIV-1 regulatory/accessory genes: Keys to unraveling viral and host cell biology. Science, 280(5371), 1880-1884.

[11]. Fanales-Belasio, E., Raimondo, M., Sullgoi, B.,& Butto, S. (2010). HIV virology and pathogenetic mechanisms of infection: A brief overview. DOAJ: Directory of Open Access Journals, 46(1), 5-14.

[12]. Friedland, G. H., & Klein, R. S. (1987). Transmission of the human immunodeficiency virus . New England Journal of Medicine. 317 (18), 1125-1135.

[13]. Gelderblom, H.R., Ozel, M., & Pauli, G. (1989). Morphogenesis and morphology of HIV structure-function relations. Archives of virology. 106 (1-2), 1-13.

[14]. Joint United Nations Programme on HIV/AIDS. (2018, July 23). Fact sheet: Latest statistics on the status of the AIDS epidemic.

[15]. Lucas, S. B., Hounnou, A., Peacock. C., Beaumel, A., Djomand, G., N'Gbichi, J.M., Yeboue, K., Honde, M., Diomande, M., Giordano, C., Doorly, R., Brattegaard, K., Kestens, L., Smithwick, R., Kaido, A., Ezani, N., Yapi, A., & De Cock, K. M. (1993). The mortality and pathology of HIV infection in a West African city, AIDS, T, 1569-1579.

[16]. Luciw. P. A. (1996). Human immunodeficiency virus and their replication. In B.N. Fields, D. M. Knippe, & P. M. Howley(Eds.) Field virology (pp. 1881-1952). Philadelphia: Lippincott-Raven.

[17]. Mark, M. (2024). The international problem of HIV/AIDS in the modern world: A comprehensive review of political, economic, and social impacts. Research Output Journal of Public Health Medicine, 42, 47-52.

[18]. Miceli, M. C., & Parnes, J. R. (1993). Role of CD4 and CD8 in T cell activation and differentiation. Advances in Immunology, 53, 59-122.

[19]. Palella, F. J, Delaney, K. M., Moorman, A. C., Loveless, M. O., Fuhrer, J., Satten, G. A., Aschman, D. J. & Holmberg, S. D. (1998). Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection. New England Journal of Medicine, 338, 853-860.

[20]. Piot. P., karim, S. S. Hecht, R., Legido-Quigley H., Buse. K., Stover, J. Resch, S. Ryckman, T., Magedal, S., Dybul, M., Goosby, E. (2015). Defeating AIDS-advancing global health. The Lancet, 386(9989), 171-218.

[21]. Pope, M., & Haase. A. (2003). Transmission acute HIV-1 infection and the quest for strategies to prevent infection. Nature Medicine,9(7), 847-852.

[22]. Salmona, M., Delarue, S., Delaugerre, C., et al. (2014). Clinical evaluation of BioPlex 2200 HIV Ag-Ab, an automated screening method providing discrete detection of HIV-1 p24 antigen, HIV-1 antibody, and HIV-2 antibody, Journal of Clinical Microbiology, 52, 103-107.

[23]. Samji, H., Cescon, A., Hogg, R, S., et al . (2013). Closing the gap: Increases in life expectancy among treated HIV-positive individuals in the United States and Canada. Plos One, 8, e81355.

[24]. Schwartiander, B., Grubb, I., & Perriens, J. (2006). The 10 year struggle to provide antiretroviral treatment to people with HIV in the developing world. The Lancet, 368 (9534), 541-546.

[25]. The Australasian Society for HIV, Viral Hepatitis and Sexual Health Medicine (ASHM). (2019). Antiretroviral guidelines US DHHS guidelines with Australian commentary, Sydney, ASHM.

[26]. Weiss, R. A. (1993). Cellular receptors and viral glycoproteins involved in retrovirus entry. In JA. Levy (Ed.). The Retroviridae (Vol 2. Pp. 1-108). New York: Plenum Press.

[27]. Whittle. H., Morris. J., Todd. J., Corrah, T., Sabally, S., Bangali. J., Nom P. T. Rolfe. M., Wilkins, A. (1994). HIV-2-infected patients survive longer than HIV-1-infected patients, AIDS, 8, 1617-1620.

[28]. Williams, E., Moso. M., Lim, C., Chibo, D., Nicholson, S., Jackson, K., & Williamson, D.A. (2023). Laboratory diagnosis of HIV: A contemporary overview in the Australian context. Pathology, 55(5), 610-620.