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An Overview to Human Immunodeficiency Virus (HIV)

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ABSTRACT

The global burden of HIV continues to be a major health concern with an estimated 39 million people living with the disease. The search for a treatment and HIV medicine resistance continues to be serious issues in spite of significant improvements in prevention and cure. In order to address antibiotic resistance, innovative approaches include optimizing antiretroviral treatment and developing newer antiretroviral medications are being investigated. Moreover, stem cell transplantation suggests a viable path toward recovery. To overcome these challenges, find a treatment, and stop new infections, continued funding for HIV development and research is essential. In this article an overview of the most serious challenges in HIV research is provided, including the complexities of HIV infection and the effects of transfusion history on the prognosis of newborns. In order to overcome the remaining gaps in HIV treatment and prevention, the essay emphasizes the significance of continued scientific research, teamwork, and funding.

Keywords: Human immune deficiency virus, antibiotic resistance, antiretroviral therapy

Introduction

The Human Immunodeficiency Virus (HIV) is the major cause of the acquired immunodeficiency syndrome (AIDS) epidemic, which has ravaged the world for over 40 years and killed approximately 40 million lives. HIV poses a severe risk to world health. HIV is a retrovirus that spreads by bodily secretions and fluids. It infects host cells, mostly T lymphocytes, through CD4 receptors and either CXCR4 or CCR5 chemokine coreceptors, destroying the immune system, this results in AIDS [1]. The person's general health and well-being are seriously at danger as their immune system weakens and leaves them more vulnerable to potentially fatal infections and tumours. Since its discovery in 1983, HIV is a new human retrovirus, has been linked to the global AIDS pandemic. The virus originated from simian immunodeficiency viruses transmitted from nonhuman primates to humans. HIV is a spherical, encapsulated virus that has a thick, conical core that houses its genetic material. The lifecycle of a retrovirus, such as HIV, involves a unique process where its RNA genetic material is converted into DNA through reverse transcription, and then this newly formed DNA is incorporated into the host cell's chromosome, allowing the virus to replicate and persist within the host [2]. HIV infection has been associated with coagulation abnormalities, including increased levels of the endothelium activation marker von Willebrand factor. HIV-related thrombocytopenia (Tr-HIV) is the most prevalent haematological complication. It affects individuals in all risk groups, regardless of age, sex, or stage of the disease, and is linked to substantial [3]. It has been possible to find antiretroviral drugs that target distinct stages of the viral life cycle. Combination antiretroviral therapy (ART) can suppress the virus for an extended period of time, greatly increasing the survival rate of persons who are infected. ART suppresses HIV infection but does not cure it. To cure HIV, efforts are being made to identify and eradicate latent HIV reservoirs.

Virology and epidemiology of HIV

The Human Immunodeficiency Virus (HIV) is a type of lentivirus that weakens the immune system, and it comes in two main forms: HIV-1 and HIV-2. HIV-2 is less harmful and has a different transmission pattern than HIV-1. HIV-1 is further divided into three subgroups: M, O, and N, with Group M being the most diverse, comprising nine distinct subtypes (A to K). Among these, Subtype C is the most widespread, responsible for nearly half (46%) of all HIV-1 infections globally [4]. The HIV epidemic has resulted in a staggering 85 million infections and 40 million deaths since its onset. As of 2022, approximately 39 million people worldwide are living with HIV, with a global prevalence of 0.7% among adults aged 15-49, although this varies significantly by region [5]. The African Region is disproportionately affected, with 1 in 25 adults (3.2%) living with HIV, accounting for over two-thirds of global cases. Encouragingly, new HIV infections have decreased by 38% since 2010, with 1.3 million cases reported in 2022. Additionally, HIV-related deaths have dropped by 51% since 2010, with 630,000 reported in 2022. As of 2022, progress has been made in treatment, with 29.8 million people receiving antiretroviral therapy, and significant percentages of individuals aware of their status (86%), receiving treatment (76%), and achieving suppressed viral loads (71%) [5].

Transmission and Symptoms

HIV can be transmitted Through the exchange of body fluids from HIV Positive individuals, including semen, blood, vaginal secretions, and breast milk. HIV infection heightens the risk of vertical transmission, leading to congenital HIV infection and adverse neonatal outcomes. Maternal transfusion history poses risks of all immunization and transfusion-related infections to the new-born [6]. In the initial months after infection, HIV transmits more readily, but many people do not become aware of their HIV infection until much later. HIV-positive individuals may also experience serious health problems if they do not receive therapy. The Symptoms are tuberculosis (TB), severe bacterial infections, severe bacterial infections, swollen lymph nodes, and cancers such as lymphomas and Kaposi's sarcoma [7].

Prevention and Treatment of HIV

HIV Risk induced by undergoing testing for sexually transmitted diseases and HIV, implementing harm reduction strategies for drug users who inject, Doctors suggests antiretroviral medications (ARVs), including as long-acting medications and oral Pre-Exposure Prophylaxis (PrEP), and injectable long acting cabotegravir [8].

Four Decades of Struggle Against HIV, Persistent Challenges and Renewed Hopes for an Effective Vaccine and Conquering Antiretroviral Drug Resistance. In April 1984, Good progress has been made in understanding HIV since Dr. Robert Gallo and his team confirmed it as the cause of AIDS in 1986. Despite this, finding a cure and effective prevention methods remain elusive goals. As of 2024, the World Health Organization estimates that between 65-113 million people have been infected with HIV, and 32.9-51.3 million have died from it. The growing issue of HIV drug resistance prompted the WHO to release an updated report in February 2024. While HIV vaccines are being developed, they are still in early-stage clinical trials. People living with HIV are more susceptible to tuberculosis, which is increasingly resistant to treatment. However, a promising vaccine, MTBVAC, is in phase 2a clinical trials, with results expected by the end of 2024, offering hope for preventing tuberculosis infection [9].

Combination antiretroviral therapy (cART) is the current gold standard for managing HIV/AIDS, effectively suppressing viral loads. However, the possibility of AIDS developing remains a concern. In a pioneering case in the late 2000s, an HIV-positive individual received stem cell transplantation (SCT) to treat a blood cancer. Remarkably, the patient achieved a double remission, with both the cancer and HIV going into remission. Comprehensive testing found no trace of the virus, leading to the declaration of the first-ever HIV cure [10].

Drug Resistance of HIV

It's a growing concern that HIV, the virus that causes AIDS, is mutating into drug-resistant strains, particularly with the most common subtype, HIV-1. While antiretroviral therapy (ART) is the standard treatment, using a combination of drugs to target different stages of the virus's life cycle, the emergence of new outbreaks with widespread geographic distribution and varying mortality rates, even among patients receiving treatment, poses a significant challenge to effective management and treatment of the virus [11]. One of the biggest challenges in the fight against the virus is the emergence of HIV strains that are resistant to antiretroviral medications, which poses a

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danger to treatment efficacy. To overcome HIV antibiotic resistance, researchers are looking into a number of methods. Among them are creating novel antibiotics with greater resistance and safety characteristics. finding new mechanisms of action, such inhibitors of attachment and maturation combining treatments to increase treatment simplicity and adherence. investigating potential pharmacological targets [12].

Challenges faced in the design of HIV cure

Since the identification of HIV and the launch of antiretroviral therapy (ART), the search for a permanent cure has taken precedence. To treat infections caused by HIV, Antiretroviral therapy was used. however, it was later shown that discontinuing therapy causes the virus to quickly reactivate, even in people whose viral levels are undetectable [13]. The virus becomes dormant in some cells, which makes its elimination challenging. Moreover, this delay clarifies why the virus can continue to exist in the bloodstream at trace amounts even with effective antiretroviral treatment. Treatment of HIV remains challenging, as seen by the current attempts to detect and eradicate the latent virus failing to produce positive results [14].

Conclusion

In conclusion, despite significant advancements in the understanding, prevention, and treatment of the virus. Global burden of HIV remains a serious issue, affecting millions of individuals globally. Top concerns are the essential for a treatment, the increase of antibiotic-resistant strains of HIV, and the continuing challenges in halting transmission. There is hope that strategies like developing new medications, Social Network Strategy testing, combining regimens, and investigating novel therapeutic targets may improve HIV management and lead to a treatment. Stem cell transplantation has shown promise in the fight against HIV; the first successful case was reported in the late 2000s. Research and innovation are essential to the eventual discovery of a cure and the prevention of the spread of new diseases.

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