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New developments in treatment of HIV

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Abstract:

HIV (Human Immunodeficiency Virus) is a global health concern that affects millions of people worldwide. This abstract provides an overview of HIV and its available treatments.

HIV is a retrovirus that primarily targets the immune system, specifically CD4+ T cells, leading to a progressive decline in the body's ability to fight off infections and diseases. It is transmitted through certain body fluids, such as blood, semen, vaginal fluids, and breast milk, commonly through sexual intercourse, sharing needles, or from mother to child during childbirth or breastfeeding.

Antiretroviral therapy (ART) is the cornerstone of HIV treatment. ART consists of a combination of different antiretroviral drugs that inhibit various stages of the viral life cycle. These medications work by suppressing viral replication, reducing viral load, preserving immune function, and slowing down disease progression.

There are several classes of antiretroviral drugs, including nucleoside reverse transcriptase inhibitors (NRTIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs), protease inhibitors (PIs), integrase strand transfer inhibitors (INSTIs), and entry inhibitors. Treatment regimens typically involve a combination of drugs from different classes to maximize effectiveness and minimize the risk of drug resistance.

Early initiation of ART after HIV diagnosis is crucial for optimal outcomes. Treatment aims to achieve and maintain an undetectable viral load, which reduces the risk of HIV transmission and helps preserve the immune system. Regular monitoring of viral load and CD4+ cell count is essential to assess treatment response and make necessary adjustments.

In addition to ART, other strategies such as pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP) are available for HIV prevention. PrEP involves taking antiretroviral medications before potential exposure to HIV to reduce the risk of infection. PEP, on the other hand, involves taking a short course of antiretroviral drugs after a potential exposure to prevent HIV transmission.

While significant progress has been made in HIV treatment, challenges remain. Adherence to lifelong treatment, potential side effects of medications, the emergence of drug resistance, and access to healthcare and medications are among the ongoing concerns.

In conclusion, HIV remains a significant global health challenge, but with the availability of antiretroviral therapy, it is now a manageable chronic condition. Timely diagnosis, early initiation of ART, and consistent adherence to treatment are crucial for improving outcomes and reducing the impact of HIV on individuals and communities. Continued research, education, and access to affordable medications are essential for achieving the goal of ending the HIV epidemic.

- **Introduction:**

There have been significant advancements in the treatment of HIV over the past few decades. Here are some of the new developments in HIV treatment:

1.Antiretroviral therapy (ART): ART is a combination of medications that suppress the HIV virus, reduce the risk of transmitting the virus, and improve the immune system. ART has improved greatly over the years, with new medications being developed that are more effective, have fewer side effects, and are easier to take.

2.Long-acting injectables: A new class of HIV medications has been developed that are long-acting injectables, which means they are given as a shot every few weeks or months, rather than taken orally every day. This has the potential to improve adherence to treatment and simplify the treatment regimen.

3.Pre-exposure prophylaxis (PrEP): PrEP is a medication that people who are HIV-negative can take to prevent them from getting HIV. PrEP has been shown to be highly effective at reducing the risk of HIV transmission when taken consistently.

4.Post-exposure prophylaxis (PEP): PEP is a medication that people who may have been exposed to HIV can take to prevent them from getting HIV. PEP is most effective when taken within 72 hours of exposure.

5.HIV cure research: While there is currently no cure for HIV, there is ongoing research into a cure. There have been some promising developments in gene therapy, which involves modifying a person's own immune cells to better fight HIV.

Overall, these developments in HIV treatment have greatly improved the lives of people living with HIV and have helped to reduce the spread of the virus. However, there is still much work to be done, particularly in addressing the social and structural factors that contribute to HIV transmission and stigma.HIV treatment advancements.

- **Antiretroviral therapy (ART) for HIV :[12-14]**

Antiretroviral therapy (ART) is a treatment for HIV that involves taking a combination of medications to suppress the virus and reduce its ability to cause damage to the immune system. ART is recommended for all people living with HIV, regardless of their CD4 cell count or how long they have been living with the virus.

The goal of ART is to reduce the amount of HIV in a person's body (viral load) to undetectable levels. When HIV is undetectable, it means that the virus is still present in the body but at such low levels that it cannot be detected by standard tests. Being undetectable is a good thing because it means that the virus is not able to cause damage to the immune system and is much less likely to be transmitted to others.

ART typically involves taking a combination of three or more medications from at least two different classes of drugs. These medications work together to target different stages of the HIV life cycle, making it more difficult for the virus to replicate and mutate. There are many different medications available for HIV treatment, and the specific combination used will depend on a person's individual needs and preferences, as well as the results of their viral load and CD4 cell count tests.

While ART cannot cure HIV, it can greatly improve a person's health and quality of life. People who take ART as directed and achieve and maintain an undetectable viral load can live long, healthy lives with HIV. However, ART is a lifelong treatment and requires regular monitoring and follow-up care to ensure its effectiveness and manage any potential side effects.

- **Long-acting injectables for HIV:[12]**

Long-acting injectables are a new class of medications for HIV treatment that are given as a shot every few weeks or months, rather than taken orally every day. These injectables contain a combination of antiretroviral medications, which work together to suppress the HIV virus and reduce the risk of transmitting the virus to others.

There are currently two long-acting injectable medications available for HIV treatment:

Cabotegravir and rilpivirine[4]: This injectable medication is given as two separate shots, one of cabotegravir and one of rilpivirine, every four weeks. It is approved for use in adults who have already achieved viral suppression with oral antiretroviral therapy.

Rilpivirine[4]: This injectable medication is given as a single shot every eight weeks. It is approved for use in adults who have already achieved viral suppression with oral antiretroviral therapy.

The use of long-acting injectables for HIV treatment has several potential benefits. First, they can improve adherence to treatment by eliminating the need to take pills every day. Second, they can simplify the treatment regimen, which may be particularly beneficial for people who have difficulty remembering to take their medication or who have other factors that make adherence challenging. Finally, they may reduce the risk of drug interactions and side effects that can occur with oral antiretroviral therapy.

However, there are also some potential drawbacks to long-acting injectables. For example, they require a healthcare provider to administer the medication, which may be inconvenient for some people. They also have a longer half-life than oral medications, which means that if a person experiences side effects or an allergic reaction, the medication may remain in their system for a longer period of time.

Overall, long-acting injectables are a promising new development in HIV treatment that may offer benefits for some people living with HIV. However, they are not appropriate for everyone and should be used under the guidance of a healthcare provider

Pre-exposure prophylaxis (PrEP):[21]

Pre-exposure prophylaxis (PrEP) is a medication that people who are HIV-negative can take to reduce their risk of acquiring HIV. PrEP works by preventing the virus from establishing a permanent infection in the body if a person is exposed to it. PrEP is highly effective when taken consistently as prescribed, with studies showing that it can reduce the risk of HIV infection by up to 99%.

PrEP is a combination of two antiretroviral medications, tenofovir disoproxil fumarate (TDF) and emtricitabine (FTC), that are taken as a daily pill. The medication works by blocking the HIV virus from replicating in the body, which prevents it from establishing a permanent infection. PrEP is most effective when taken consistently, with studies showing that taking the medication at least four times a week provides high levels of protection against HIV.

PrEP is recommended for people who are at high risk of acquiring HIV, including:

Men who have sex with men

Transgender individuals

People who have sexual partners with HIV

People who inject drugs

People with a history of sexually transmitted infections (STIs)

PrEP is available by prescription from healthcare providers and is typically covered by insurance. In some cases, PrEP may also be available through public health programs or community organizations.

While PrEP is highly effective at preventing HIV infection, it is not 100% effective and should be used in combination with other prevention methods, such as condoms and regular HIV testing. People who take PrEP also need to have regular medical check-ups to monitor their health and ensure that they are not experiencing any side effects from the medication.

- **Post-exposure prophylaxis (PEP):[22]**

Post-exposure prophylaxis (PEP) is a medication that people who may have been exposed to HIV can take to reduce their risk of acquiring the virus. PEP involves taking a combination of antiretroviral medications within 72 hours of exposure to HIV, and continuing to take the medication for a period of 28 days.

PEP is typically recommended for people who have had a high-risk exposure to HIV, such as:

Unprotected sex with a partner who has HIV or whose status is unknownSharing needles or other injection equipment with someone who has HIV or whose status is unknownSexual assault or other non-consensual sexual activityPEP is most effective when started as soon as possible after exposure to HIV, ideally within 24 hours. The medication works by blocking the virus from replicating in the body, which prevents it from establishing a permanent infection.It is important to note that PEP is not 100% effective and is not a substitute for other prevention methods, such as condoms and regular HIV testing. Additionally, PEP can cause side effects, including nausea, vomiting, and diarrhea. These side effects are usually mild and go away on their own within a few weeks.

PEP is available by prescription from healthcare providers and is typically covered by insurance. In some cases, PEP may also be available through public health programs or community organizations. It is important to seek medical attention as soon as possible after a potential exposure to HIV to determine if PEP is appropriate and to start the medication as soon as possible if it is recommende

- **HIV cure research:**[14-17]

HIV cure research is an active area of investigation, with researchers working to develop treatments that can eliminate the virus from the body or achieve a functional cure, where the virus is present but does not cause harm to the body.

There are several approaches that are being explored in HIV cure research, including:

Latency-reversing agents (LRAs):LRAs are drugs that activate dormant HIV-infected cells, which can then be targeted and eliminated by the immune system or antiretroviral medications. However,current LRAs have had limited success in eliminating the virus from the body, and more research is needed to develop more effective drugs.

- **Gene editing:**

Gene editing technologies like CRISPR/Cas9 are being investigated as a potential tool to remove HIV from infected cells. However, this approach is still in the early stages of research, and more work is needed to develop safe and effective gene editing strategies.

- **Immune-based therapies:**

Immune-based therapies are being explored to enhance the immune system's ability to target and eliminate HIV-infected cells. This includes approaches like therapeutic vaccines, which stimulate the immune system to recognize and target HIV, and immunotherapies, which use antibodies or other immune-based molecules to target and eliminate HIV-infected cells.

While there is no cure for HIV yet, antiretroviral therapy (ART) has been highly effective at suppressing the virus and allowing people with HIV to live long, healthy lives. Additionally, some people with HIV have achieved long-term remission or even a functional cure, where the virus is present but does not cause harm to the body, through treatments like bone marrow transplants or early initiation of ART. HIV cure research is an important area of investigation, and it is hoped that new treatments will eventually lead to a cure for HIV.

1) Latency-reversing agents (LRAs):[16]

Latency-reversing agents (LRAs) are drugs that activate dormant HIV-infected cells, which can then be targeted and eliminated by the immune system or antiretroviral medications. HIV can persist in the body for many years in a latent form, hiding in immune cells and evading the immune system and antiretroviral therapy. LRAs are being investigated as a potential way to eliminate this reservoir of latent virus and achieve a cure for HIV.

The goal of LRA treatment is to activate the latent HIV in the body so that it becomes visible to the immune system, which can then target and eliminate the virus. LRAs work by activating gene expression in the HIV-infected cells, which can trigger viral replication and expose the virus to the immune system.

Several classes of LRAs have been developed and are currently being studied in clinical trials, including:

2)istonedeacetylase (HDAC) inhibitors: HDAC inhibitors are drugs that modify the structure of chromatin in the infected cells, making the HIV genes more accessible for expression. Some examples of HDAC inhibitors that are being studied include vorinostat and romidepsin.

3)Protein kinase C (PKC) agonists: PKC agonists are drugs that activate the PKC signaling pathway in the infected cells, which can activate the expression of HIV genes. Examples of PKC agonists that are being studied include bryostatin-1 and ingenol-B.

4)Disulfiram: Disulfiram is a drug that is used to treat alcohol addiction, but has also been found to activate latent HIV in laboratory studies. Disulfiram is currently being studied in clinical trials as an LRA.

While LRAs hold promise as a potential cure for HIV, there are several challenges that need to be overcome. LRAs may not be able to target all HIV-infected cells, and some cells may not respond to LRA treatment. Additionally, LRAs may cause inflammation or immune activation in the body, which can have negative effects on health. Researchers are continuing to study LRAs in clinical trials to better understand their potential as a cure for HIV.

- **Gene editing for hivtreatment :**

Gene editing is a rapidly evolving field that holds promise for treating a wide range of diseases, including HIV. One approach to using gene editing to treat HIV involves modifying immune cells to make them resistant to the virus.This can be achieved by using a technique called CRISPR/Cas9, which allows researchers to precisely edit the genetic material of cells. In this case, scientists would use CRISPR/Cas9 to remove a specific gene called CCR5 from the immune cells. This gene is the main gateway for HIV to enter and infect immune cells, so removing it would make the cells resistant to the virus.

Several clinical trials are currently underway to test this approach. In one such trial, researchers removed immune cells from HIV-positive patients, used CRISPR/Cas9 to edit the cells' genes to remove the CCR5 gene, and then reinfused the cells back into the patients. The goal of the trial is to determine if this approach is safe and if it can reduce the viral load in the patients.

While gene editing holds promise for treating HIV, it is important to note that this technology is still in the early stages of development and there are many challenges that must be addressed before it can become a widely used treatment. However, the potential benefits of gene editing for HIV treatment are significant, and research in this area is ongoing.

- **Immune therapy for HIV:**

Immune therapy for HIV refers to a variety of treatments that aim to enhance the body's immune response against the virus. While there is no cure for HIV, immune therapy has been shown to be effective in reducing the viral load in some patients and improving their quality of life.

One type of immune therapy for HIV is called immune checkpoint inhibitors. These drugs work by blocking proteins that inhibit the immune system's ability to fight the virus. By blocking these proteins, immune checkpoint inhibitors can help the body's immune cells recognize and attack HIV-infected cells more effectively.

Another type of immune therapy for HIV involves using monoclonal antibodies, which are laboratory-produced proteins that mimic the immune system's natural response to infections. These antibodies can bind to specific molecules on the surface of HIV-infected cells and flag them for destruction by the immune system.There is also ongoing research into the use of therapeutic vaccines for HIV. These vaccines aim to stimulate the body's immune system to recognize and attack HIV-infected cells. While there is currently no FDA-approved therapeutic vaccine for HIV, several vaccines are being tested in clinical trials.

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