Antiviral Chemotherapy (Antiviral Drugs)

Principles of antiviral therapy

Compared with the number of drugs available to treat bacterial infections, the number of antiviral drugs is very small. The major reason for this difference is the difficulty in obtaining **selective toxicity** against viruses; because viruses are obligating intracellular parasites; their replication depends on synthetic processes of the host cells. Therefore, anti-viral agents will also be anti-cell agents according to the close interaction between virus replication and normal cellular metabolism. This makes it difficult to find **targets for the drug** that would interfere specifically with the viral activities without causing harm to the host organism's cells activities. Despite the difficulty, several virus-specific replication steps have been identified that are the sites of action of effective antiviral drugs.

Antiviral drugs are a class of medications used for treating viral infections, it’s a prescription medicines include pills, liquid, an inhaled powder, or an intravenous solution, that fight against viruses in the body. Most antivirals target specific viruses, while a broad-spectrum antiviral is effective against a wide range of viruses. Unlike most antibiotics, antiviral drugs do not destroy their target pathogen; instead they inhibit its development.

The essential concepts of antiviral chemotherapy are:

- Able to enter the cells infected with virus.
- Interfere with viral nucleic acid synthesis and /or regulation.
- Some agent interfere with virus ability to bind with cell.
- Some agents stimulate the body's immune system.

Antiviral drugs are act by different mechanisms of action (in combination or single action) as follows:

1. Inhibit viral attachment.
2. Prevent genetic copying of virus.
3. Prevent viral protein production, vital for reproduction of virus.

Examples of antiviral drugs that inhibit different viral Events

- **Amantadine, rimantadine**: inhibits uncoating by blocking matrix protein in Influenza virus.
- **Maraviroc**: inhibits attachment to cell surface receptor in HIV.
- **Acyclovir, ganciclovir**: inhibit nucleic acid synthesis by herpesviruses.
- **Oseltamivir, zanamivir**: inhibit release of influenza virus from infected cells.

One Principle Mechanism for Development of Resistance

Drug-resistant virus isolates are found to have one or more **mutations** in the genes encoding the proteins that are the drug targets.

All viruses have one main mechanism for development of resistance to antiviral compounds and vaccines, it's the selection of random mutations. Random changes followed by survival of the fittest mutation —is well illustrated in the virus field.

Management of drug resistance

- Selection of alternative therapies based on knowledge of mechanisms of resistance.
- Development of new antivirals.

- Introduction of antiviral combination therapy as a crucial feature to control chronic virus infections.

Viral Vaccines

Because few drugs are useful against viral infections, prevention of infection by the use of vaccines is very important. Prevention of viral diseases can be achieved by the use of vaccines that induce active immunity.

Principles of vaccines action

Vaccines can be divided into a number of different types, but ultimately work on the same principle. This is to stimulate the immune response to recognize a pathogen (a disease-causing organism) or part of a pathogen that are not normally found in the body, then to produce an immune response similar to that seen during natural infection.

Types of vaccines

There are two types of vaccines that induce **active** immunity:

1. Live-attenuated vaccines: those that contain **live virus** that attenuated (weakened) to lost its pathogenicity (unable to cause disease), but retains its antigenicity and can induce immune response protection, examples:

- Rotavirus vaccine.
- MMR vaccine.
- Nasal flu vaccine.
- BCG vaccine against TB.

2.Inactivated vaccines: also called **killed vaccines**, those that contain **killed virus or virus particles** that have been grown in culture and then killed to destroy disease-producing capacity, examples:

- Inactivated polio vaccine.
- Rabies vaccine.
- Hepatitis A vaccine.

Interferons (IFNs)

A group of signaling proteins belong to the large class of proteins known as cytokines, used for communication between cells to trigger the protective defenses of the immune system that help eradicate pathogens. IFNs, made and released by host cells in response to the presence of several viruses, a virus-infected cell will release interferons causing nearby cells to heighten their anti-viral defenses.

Interferons are named for their ability to "interfere" with viral replication by protecting cells from virus infections.

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