

Viral Infections- A Wide Scope of Study

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Abstract

India is a country which is full of natural recourses on all direction of land such as snow fall on northern India, highest rainfall in northeast, hot desert on west and damp sea air on remaining costal area. Such types of climates are hardly available in any country in the world. Due to all this three seasons are observed in India, like summer, Rainy season, and winter. Because of change in climates there will be sudden growth of microorganism in atmosphere and chances to increase the illness in common people. The illness due to change in season is called as viral infections. Generally viral infections include sneezing, coughing, cold, fever, body ache etc. Depending upon the immunity of individual number of patients are cure within in few days either by oral analgesic, anticold, or basic antibiotics or by simply OTC medicines but few were treated with IV antibiotics. Majority of people complaint with sore throat, patches in throat, because of cold air entered in respiratory tract and produces running nose and irritation in throat. Number of viruses is pathogenic in human being producing a variety of syndromes. In a large majority of the cases, viral infections are not apparent or subclinical; only in some of them is a clinical disease produced. Clinical illness following a virus infection depends upon factors in the virus and the host. The very important factor in a virus is genomic alterations. The factors in the host mostly depend upon the nutritional status and the immune system. The life cycle of a virus starts with its entry into a host; it reaches the susceptible target cell, enters it, replicates and causes cell injury, and may be cell death. At any of these steps the life cycle of the virus can be aborted by various body mechanisms, mainly by the immune response. A single cough can release hundreds of droplets, a single sneeze thousands (up to 40 000) each droplet containing millions of viral particles.

Keywords: Viral Infection, Antiviral Drugs, Cold and Flu.

Introduction

India is a country which is full of natural recourses on all direction of land such as snow fall on northern India, highest rainfall in northeast, hot desert on west and damp sea air on remaining costal area. Such types of climates are hardly available in any country in the world. Due to all this three seasons are observed in India, like summer, Rainy season, and winter. Because of change in climates there will be sudden growth of microorganism in atmosphere and chances to increase the illness in common people. The illness due to change in season is called as viral infections. Generally viral infections include sneezing, coughing, cold, fever, body ache etc. Depending upon the immunity of individual number of patients are cure within in few days either by oral analgesic, anticold, or basic antibiotics or by simply OTC medicines but few were treated with IV antibiotics. Majority of people complaint with sore throat, patches in throat, because of cold air entered in respiratory tract and produces running nose and irritation in throat. Number of viruses is pathogenic in human being producing a variety of syndromes. In a large majority of the cases, viral infections are not apparent or subclinical; only in some of them is a clinical disease produced. Clinical illness following a virus infection depends upon factors in the virus and the host. The very important factor in a virus is genomic alterations. The factors in the host mostly depend upon the nutritional status and the immune system. The life cycle of a virus starts with its entry into a host; it

reaches the susceptible target cell, enters it, replicates and causes cell injury, and may be cell death. At any of these steps the life cycle of the virus can be aborted by various body mechanisms, mainly by the immune response. A single cough can release hundreds of droplets, a single sneeze thousands (up to 40 000) each droplet containing millions of viral particles. Aerosol droplets travel only short distances (1-2 meters) before settling on surfaces, where viruses can remain infectious for hours or days. Survival of Virus is influenced by temperature, humidity, pH and exposure to ultraviolet light. Hand shaking that come into contact with these surfaces become contagious. Secondary aerosolization can occur when air displacements disperse the viruses back into the air from contaminated surfaces. Infections that have newly appeared in a population or have existed previously but are rapidly increasing in incidence or geographic range, is known as Emerging infections. These can be further classified as newly emerging, re-emerging or 'deliberately emerging, since the underlying causes of emergence and preventive strategies differ between these groups. Newly emerging infections are those that have not previously been recognized in man. Re-emerging and resurging infections are those that existed in the past but are now rapidly increasing in incidence or in geographical or human host range. Viruses are of different types such as Enveloped, Nonenveloped, single stranded, double stranded etc. Nonenveloped viruses are mainly controlled by the human immunity.

Enveloped viruses are controlled by the cellular immunity through the action of natural killer cells and cytotoxic CD8+ T lymphocytes. After recognizing viral surface antigens on infected cells, cytotoxic T lymphocytes inhibit virus replication by cytolytic killing and by releasing interferons, chemokines, tumor necrosis factor other pro-inflammatory mediators.

Classification of Viruses

Classification of viruses depends upon presence of DNA or RNA, single-stranded or double-stranded nucleic acid, and an enveloped or nonenveloped nucleocapsid. Additional taxonomical criteria include mode of replication, type of host, capsid shape, immunological properties and disease association.

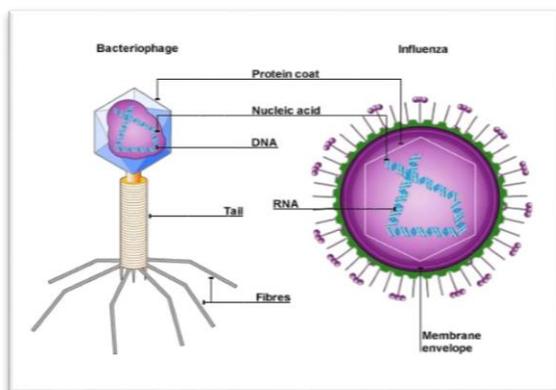


Fig. 1

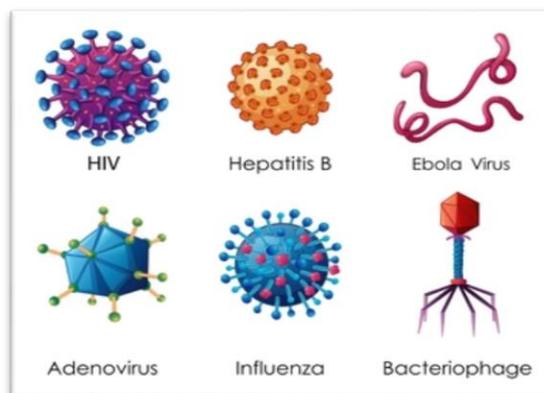


Fig. 2

Different Types of Viral Infections

Common viral infection is Respiratory Infection. Respiratory infection affects the nose, upper airways and lungs throat. Most common respiratory infection includes a common cold, soreness of throat, sinus, pneumonia and influenza. Respiratory infection causes a lot of troubles in infants, older people and people suffering from lung or heart disorder.

Other parts/organs of the human body affected by virus;-

- Liver: The presence of virus in liver can causes Hepatitis.
- Gastrointestinal tract: The presence of virus in the gastrointestinal tract, like gastroenteritis, is usually caused by rotavirus and norovirus.
- Nervous System: Some viruses like rabies virus infect human brain and cause encephalitis. There are some other viruses that infect the tissue layer covering the brain and spinal cord. These can cause meningitis.
- Skin: Some viruses' causes skin infection which result in blemishes or warts. Many viruses that affect other body organs or parts, like chickenpox can cause rashes on the skin.

Various Diseases Caused by Virus:

- Cold
- Measles

- Smallpox
- Influenza
- Chickenpox
- Hepatitis
- Polio
- Rabies
- HIV (Human Immunodeficiency Virus)
- Ebola
- Dengue
- Shingles
- Herpes
- Cold Sores
- SARS (Severe Acute Respiratory Syndrome)

Common symptoms of Viral Infection-

- Sore throat
- Abdominal Pain
- Coughing
- Runny nose
- Nausea and vomiting
- Muscle ache
- Chills
- High Fever
- Tiredness or Fatigue
- Headache
- Diarrhea
- Skin rash
- Stiffness in neck
- Seizures
- Loss of sensation
- Impaired bladder
- Impaired bowel function
- Paralysis of limbs
- Sleepiness
- Confusion

Viral Infection become serious

Almost every person has had flu or a bad cold at least once in their lifetime. So usually, a viral infection is not that serious. However, at times, such infections can become extremely troublesome. Below mentioned

are some of the scenarios when a virus led infection can be considered serious:

- Complaints and symptoms lasting for more than seven days
- High fever lasting for more than five days
- Breathlessness
- New reddish rash or spots on the body.

How to prevent yourself from Viral Infection?

When it comes to an infection caused by a virus, the treatment is a little difficult as viruses live inside the body's cells. They are 'protected' or 'immunized' from most of the medicines. There are few basic things that a patient suffering from such infection should keep in mind:

- Take adequate rest
- Keep yourself well hydrated
- Eat light food
- Wash your hands regularly to avoid infection spreading to others
- When suffer with viral respiratory infection, try to stay away from childcare, preschool, school and work until well.
- Wash hands as soon as possible after sneezing or coughing and after contact with nose and throat discharges or articles soiled by these.
- Use soap and water or an alcohol based hand sanitizers.
- Cover a cough or sneeze with tissue or arm.
- Drop used tissues immediately into a rubbish bin, and wash hands afterwards.
- Wipe down all frequently touched surfaces regularly with a cleaning cloth dampened with detergent, or with a large alcohol wipe.
- Avoid sharing cups, glasses and eating utensils with people who have respiratory infections.

Unlike bacterial infections which can be treated with medicines/antibiotics, viral infections require either vaccinations to prevent them spreading at the first stage or antiviral drug to treat them. Vaccinations are usually the cheapest way to prevent virus led infections. It is also one of the most effective ways to counter such infections. Vaccinations are available for polio, mumps, rubella, measles among others. It is important to mention that vaccination has played a huge and instrumental role in eliminating diseases like smallpox, and reducing many other viral diseases to an extremely rare status. Infections cause by virus tend to resolve on their own, without any treatment. Till the time infection is present in the body, the treatment mostly focuses on providing relief to the symptoms one is experiencing such as fever, cold, cough, pain etc.

Viral Infection in Children

Children are more susceptible to viral infection as compare with adult, because of the immune system of a child is not as strong as that of adult and hence, the infection persists for a longer duration in their body. Sometimes infections become very serious while some

just make a child feel unwell. Many a times, children develop fever, headache, runny nose, fatigue. These signs are a result of the battle between the virus and the body's immune system. Hence, it is important to take care of certain things when a child is infected with virus led infection:

- Children should take rest when they are affected with viral infection.
- Children cannot blow their nose, parents can use rubber suction bulb to suck drainage from both sides of the child's nose.
- Children should be given sufficient lukewarm water and fruit juices, soups to keep them well hydrated.
- Parents must avoid giving milk to infants as it can result in congestion.
- Parents should also use nebulizer or hot steam to loosen the mucus in child's nasal passage and chest.

Diagnosis of Viral Infections

The diagnosis of a viral infection is usually based on the physical symptoms and the history of the illness. A condition such as influenza, which is caused by a virus, is generally easy to diagnose because most people are familiar with the symptoms. Other types of viral infections may be harder to diagnose and various tests may have to be performed.

Various Diagnostic Tests for Viral Infections

- Blood tests.
- CBC, Bilirubin and Widal tests.
- Cultures for samples of blood, bodily fluid, or other material taken from the infected area
- Spinal tap to examine the cerebrospinal fluid
- Polymerase chain reaction (PCR) techniques may be used to make many copies of the viral genetic material, enabling doctors to rapidly and accurately identify the virus
- Magnetic resonance imaging (MRI) can detect increased swelling in the temporal lobes.

Treatment for Viral Infections

Not such a specific treatment is required for mild viral respiratory infections. Most people recover with rest and drinking plenty of fluids. Paracetamol may be used for relief of symptoms but must be used according to the manufacturer's instructions. Aspirin should not be given to children under 12 years of age unless specifically recommended by a doctor. Antiviral medication may be used for severe or prolonged viral respiratory infections such as influenza virus infection. Antibiotics do not help even though they are often prescribed.

Vaccines – as a preventive treatment

Vaccines are useful for preventions and building immunity to virus. Some diseases are there where drugs are limited. Vaccines are prepared by using live viruses, killed viruses, or molecular subunits of the virus. Live viral vaccines are designed in the laboratory to cause

few symptoms in recipients while giving them protective immunity against future infections. Polio was one disease that represented a milestone in the use of vaccines.

Mass immunization campaigns in the 1950s (killed vaccine) and 1960s (live vaccine) significantly reduced the incidence of the disease, which caused muscle paralysis in children and generated a great amount of fear in the general population when regional epidemics occurred. The success of the polio vaccine paved the way for the routine dispensation of childhood vaccines against measles, mumps, rubella, chickenpox, and other diseases.

It is dangerous to use live vaccines, which are usually more effective than killed vaccines, is the low but significant danger that these viruses will revert to their disease-causing form by back mutations. Live vaccines are usually made by attenuating (weakening) the “wild-type” (disease-causing) virus by growing it in the laboratory in tissues or at temperatures different from what the virus is accustomed to in the host. These attenuated viruses’ thus still cause infection, but they do not grow very well, allowing the immune response to develop in time to prevent major disease. Back mutations occur when the vaccine undergoes mutations in the host such that it readapts to the host and can again cause disease, which can then be spread to other humans in an epidemic. This type of scenario happened as recently as 2007 in Nigeria where mutations in a polio vaccine led to an epidemic of polio in that country.

Vaccines can be used to treat an active viral infection. The concept behind this is that by giving the vaccine, immunity is boosted without adding more disease-causing virus. In the case of rabies, a fatal neurological disease transmitted via the saliva of rabies virus-infected animals, the progression of the disease from the time of the animal bite to the time it enters the central nervous system may be 2 weeks or longer. This is enough time to vaccinate an individual who suspects that they have been bitten by a rabid animal, and their boosted immune response is sufficient to prevent the virus from entering nervous tissue. Thus, the potentially fatal neurological consequences of the disease are averted, and the individual only has to recover from the infected bite. This approach is also being used for the treatment of Ebola, one of the fastest and most deadly viruses on earth. Transmitted by bats and great apes, this disease can cause death in 70–90 percent of infected humans within 2 weeks. Using newly developed vaccines that boost the immune response in this way, there is hope that affected individuals will be better able to control the virus, potentially saving a greater percentage of infected persons from a rapid and very painful death.

Anti-viral Drugs for Treatment

Secondly the antiviral drugs. They have limited success in curing viral disease, but in many cases, they

have been used to control and reduce symptoms for a wide variety of viral diseases. For most viruses, these drugs can inhibit the virus by blocking the actions of one or more of its proteins. It is important that the targeted proteins be encoded by viral genes and that these molecules are not present in a healthy host cell. In this way, viral growth is inhibited without damaging the host. There are large numbers of antiviral drugs available to treat infections, some specific for a particular virus and others that can affect multiple viruses.

Antiviral have been developed to treat genital herpes (herpes simplex II) and influenza. For genital herpes, drugs such as acyclovir can reduce the number and duration of episodes of active viral disease, during which patients develop viral lesions in their skin cells. As the virus remains latent in nervous tissue of the body for life, this drug is not curative but can make the symptoms of the disease more manageable. For influenza, drugs like Tamiflu (oseltamivir) (Figure 3) can reduce the duration of “flu” symptoms by 1 or 2 days, but the drug does not prevent symptoms entirely. Tamiflu works by inhibiting an enzyme (viral neuraminidase) that allows new virions to leave their infected cells. Thus, Tamiflu inhibits the spread of virus from infected to uninfected cells. Other antiviral drugs, such as Ribavirin, have been used to treat a variety of viral infections, although its mechanism of action against certain viruses remains unclear.

More on Viral Infection

Nowadays viruses are spreading from one part of world to other part rapidly. These viruses include Chikungunya Virus, ZikaVirus, Ebola Virus, Japanese Encephalitis Virus, West Nile Virus, Rift Valley Fever Virus etc. One of the main reasons of these viral infections spreading across is the changing climate that has resulted in more breeding areas for the mosquitoes that spread the deadly viruses. Another reason could be travelers getting infected from a virus, then returning home after being bitten by the mosquito that spread virus to others. Chikungunya is a typical example of this. Chikungunya is spread through mosquitoes and was first identified in Africa but has now spread to India, Caribbean and Central, South and North America. In Chikungunya viral infection, the patient experiences high fever, headache, muscle and joint pain, swelling and / or body rash.

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