Ilkogretim Online - Elementary Education Online, 2021; Vol 20 (Issue 4): pp.4466-4472
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2021.04.481

Viruses And Human Diseases

****Khushi Kashyap, **Arsh Singh, **Simran Srivastava, Amit Gupta*****

**Department of Life Sciences and Biotechnology, Graphic Era (Deemed to be) University, Dehradun

***Assistant Professor Department of Mechanical Engineering, Graphic Era Hill University, Dehradun

*Corresponding author Dr. Amit Gupta Associate Professor Department of Life Sciences Email address- dr.amitgupta.bt@geu.ac.in

ABSTRACT

Viruses are tiny creatures having a core of genetic material, either DNA or RNA, that cause a variety of diseases that can be dangerous at times. Viruses are also responsible for the common cold, hepatitis, polio, rabies, measles, HIV, rabies, mumps, and other disorders. Mild to deadly viral illnesses are all too common. Infected host cells might burst open and perish as a result of viral infection. Without destroying host cells, viruses can still spread disease. They might make the host cells' homeostasis unbalanced, leading to disease. In the body, certain viruses exist in a latent state and known as latency. For instance, a young child may contract the short-term illness chicken pox from the chicken pox virus. The virus might then spend years dormant in nerve cells across the body. Later in life, the virus may reappear as the condition known as shingles. The virus that causes shingles also produces painful skin rashes and blisters. Shingles is a virus-borne disease that is caused by the very same virus that triggers chicken pox. Some viruses have been linked to cancer. For instance, the human papillomavirus (HPV) can lead to cervix cancer in females. Liver malignancy is caused by the hepatitis B virus only when a person has had a virus infection for a long period is viral cancer likely to develop. Certain methods of prevention are accessible, and so are vaccinations, which must be administered at the appropriate time. This study emphasizes important information regarding viruses, shapes, structures, symptoms, and the prevention of various diseases.

Keywords: Viruses; DNA; RNA; viral; disease; prevention.

INTRODUCTION

A virus is a contagious and transmissible submicroscopic critter that only propagates inside live cells **[1]**. Viruses can contaminate some forms of life i.e. bacteria, archaeabacteria, animals and plants **[2, 3].** Viruses are the most habitual attribute of living organism and can be set up or established in almost all ecosystems on Earth. A host cell that has been contaminated is regularly urged to speedily make millions of replicas of the parent virus. When not within an

infected host or in the course of invading a cell, viruses reside as separate particles, or virions, made up of, (i) genetic material, or lengthy strands of RNA or DNA that codify the shape of the protein by which the virus operates; (ii) a protein coat, or capsid, that bordering and shields the genetic information; and (iii) an external lipids envelope. These virus particles come in a variety of shapes, from straightforward icosahedral and helical forms to more intricate ones. The majority of virus strains have virions that are 100th the dimension of most bacteria and are too tiny to be observed using an optical microscope **[4, 5]**.

Viruses can spread in numerous ways. One method of transmission involves the employment of disease-carrying creatures known as vectors. For instance, aphids, which feast on plant sap, are frequently used to spread viruses from one plant to another, and insects that feast on blood can also carry viruses that affect mammals **[5-8].**

Coughing and sneezing are two common ways for viruses to spread in the air, such as chickenpox, influenza viruses, measles, SARS-CoV-2, and smallpox. The major sources of viral gastroenteritis, norovirus and rotavirus, are conveyed from person to person through hand-to-mouth contact, infected food, or water. Less than 100 infectious norovirus particles are necessary to cause infection in humans **[9-10].** One of the many viruses that can be spread by sex and contact with blood that has been infected is HIV. A virus's "host range" refers to the selection of host cells that it can contaminate. A virus may have a small compass of host species it may contaminate or a vast domain of host species it can infect **[11-13].**

Animals with viral infections experience an immunological reaction, which often clears the virus from the body. Vaccines, which impart a synthetically acquired susceptibility to a particular viral illness, can also trigger immune responses. Some viruses, such as those that result in viral hepatitis, HPV infection, and HIV/AIDS manage to elude these immune reactions and produce chronic infections. Antiviral medications have been produced in many classes.

VIRAL STRUCTURE

Since viruses are acellular physiological processes, cell morphology is likely where they fall short. Ribosomes, organelles, and the plasma layer are thus lacking, among other cell components. A virion is made up of three components: a nucleic acidic centre, an outer protein covering called a capsid, and, in some circumstances, an outer envelope with cell protein and phospholipid layers. Proteins found in capsids are called capsomeres. A variety of proteins, as well as compounds, may be present in infections. Their morphology, which varies frequently, provides the most obvious distinction between viral relatives **[4-8].** A convincing characteristic of viral complexity is the independence of host and virion complexity. The most bizarre virion designs are most likely found in bacteriophage infections, which infect the tiniest living things. A hereditary material core, either DNA or RNA, can be found in the tiny single - celled organisms known as viruses. They are tiny organisms that can either contain DNA or RNA as their genetic material. The centre is surrounded by a capsid, a protective layer made of proteins. There is a spiky coating on the envelope that can completely enclose the capsid. These spikes, which are proteins, allow infections to interact with and invade cells. If the environment is favourable, they may grow in number. Since ribosomes are required, they are also unable to combine proteins. In order to imitate, they must rely solely on their host because they lack the necessary tools. By introducing its own genetic material and proteins, a virus enters a host cell and seizes

it. By utilising the host's cell hardware, it multiplies. The infection then continues, but this time it produces viral protein and genetic material rather than the usual cell components **[2-6].**
Viruses are categorised according to the organisms they infect, which can range from mammals to plants to microorganisms. Because viruses are unable to enter through plant cell walls, practically all plant viruses are escalated by insects or other animals that nourish on plants. Certain bacterial viruses (i.e. T4 bacteriophage), have expand and produced a sophisticated infecting mechanism. The virus has a "tail" that it sequestrates to the bacteria's surface with proteinaceous "pins." The tail plug enters the cell and injects viral nucleic acids through the cell wall and overlying membrane. On the basis of families including genera, viruses are divided on the basis of structural features-

- Nucleic acid (nature and size)
- Capsid (size and structure)
- Lipid envelope existence around the nucleocapsid.

Virus morphologies are classified into two types: Rods and filaments are the names given to the sequences of nucleic acid including protein constituents, respectively.

STRUCTURE DESCRIPTION [8-13]

- **Capsid:** protein shells that neighbouring the nucleic acid. Capsomers, which are protein subunits, make up this shell. Viral RNA in a fluid medium of protein complexes will self-assemble a capsid to flatter a virus (live and infectious) under the precise happenings.
- **Envelope:** Many viruses have a glycoprotein envelope that envelopes their nucleocapsid. Two lipid layers are interlaced with protein molecules to form the envelope. It may include both host cell membrane and viral membrane components. Spikes on the envelopes of some viruses aid in attachment to specific cell surfaces.
- **Nucleic acid:** The nucleic acid of each virus, like that of cells, encodes the genetic information for the synthesis of all proteins. Most viruses store all of their genetic information in single-stranded RNA. Positive and negative strand RNA viruses exist.

Two types of virus structures can be distinguished: rods, or fibres, named after the linear arrangement of proteins, nucleic acids, and spheres, which are essentially 20-sided (icosahedral) polygons. The majority of plant viruses are small and framed like threads or polygons, just like other bacterial infections.

CAUSES OF VIRAL DISEASES

The majority of viral infections are generated when a virus enters the human body and uses the host machinery to multiply. Viruses grow and spread to other cells when the body's immune system fails to combat them, resulting in infections.
Viruses are responsible for a wide variety of human ailments. The Epstein-Barr virus, for example, can cause mono. Some viruses, such as HPV, have been linked to cancer. The full impact of a virus might take months to show, and there may be unintended consequences. Chickenpox can be caused by the herpes zoster virus, for example. The person recovers, yet the infection may persist in the body. The same person may acquire shingles years later **[8-10].**

AN IMMUNOLOGY-BASED APPROACH TO VIRUS CONTROL

The immune system of the body starts to take preventative action as soon as it recognizes a virus. Viruses that have entered the body's cells are invisible to the immune system. Cytotoxic T cells are a subset of T cells that can recognise and kill virus-infected cells. Even though some viruses can evade the cytotoxic T cells' identification, other immune cells called natural killer cells can destroy the virus-carrying cell. Additionally, interferons, a class of proteins that notify other cells of the presence of viruses, are produced by body cells that harbor viruses. As a result, healthy cells may defend themselves by changing the chemical makeup of their surface. Before viruses enter cells, antibodies can help in the fight against them. They do this by neutralizing, killing, or changing the virus's properties such that it can no longer enter healthy cells. If a person has been exposed to a virus before or has had a vaccine, they may develop antibodies **[14, 15].**

SYMPTOMS OF VIRAL DISEASES

Flu-like symptoms such as fever, tiredness, sore throat, and headache are the most frequent symptoms of viral infections. Excessive weight loss, irritability, rashes, malaise, sneezing, enlarged tonsils are major symptoms of viral diseases. Some of them are-

a) **RABIES:** Caused by Rabies lyssavirus. Rabies virions are bullet-shaped and coated with spike-like glycoprotein peplomers measuring 10 nm in length. The ribonucleoprotein is composed of RNA wrapped in nucleoprotein-(), virus phosphorylated or viral phosphoprotein-Illustration, and virus polymerase. The first indications of rabies may be similar to flu symptoms, such as weakness or soreness, fever, or headache. Soreness, prickling, or itching may also occur at the bite site. These sensations might last for days. Cognitive impairment, anxiety, confusion, and agitation are among the symptoms. Regarding vaccines, human diploid cell culture is used to produce the HDCV vaccine (Imovax, Sanofi Pasteur). In chick embryo cell culture, the PCECV vaccine (RabAvert, Novartis) is manufactured. Both types are thought to be equally safe and effective **[11-14].**
b) **SMALL POX:** Caused by Variola virus. Poxviruses have large double-stranded DNA genomes and are brick or oval in form. The following are the stages of the most prevalent kind of smallpox and its initial symptoms last around three days. The major symptoms are high temperature, muscular pains and a body-wide rash emerges after the initial symptoms. The virus can spread through talking, sniffling, or hacking. When the underlying rash is present: tongue, as well as the mouth and throat, develop a rash. Mouth ulcers that grow from red patches break **[13-17].**
    - Pus-filled bumps on your skin (thick fluid). Each bump may have a dent in the centre. The lumps take around two days to fill with fluid.
    - Scabs and pustular rash: Bumps develop into pustules (firm, round lumps). Crusty scabs form over the pustules over the next 10 days. Scabs begin to fall off about a week afterwards. Scabs usually fall off in three weeks.
    - They leave scars when they fall off. A smallpox patient is contagious until the final scab breaks off.

Aventis Pasteur Smallpox vaccine or APSV ACAM2000® and APSV both have comparable security profiles and are replication-capable vaccines against vaccinia infections. It is a vaccination that is being tested.

c) **HEPATITIS-** Caused by Hepatitis A virus, Hepatitis B virus, Hepatitis C virus. The infectious HBV virion is 42 nm long and composed of a lipid envelope containing HBsAg that surrounds an inner nucleocapsid containing HBcAg complexed with virally encoded polymerase and the viral DNA genome. The major symptoms are fever, exhaustion, loss of appetite, nausea, vomiting, abdominal pain, dark urine; light-coloured faeces, joint pain, and jaundice are all symptoms of hepatitis. Both Havrix and Vaqta provide effective hepatitis A prevention. Combination vaccine i.e. hepatitis-b-hepatitis-a-vaccine injection (Twinrix) that protects against both hepatitis A and hepatitis B **[15, 16].**

d) **MEASLES-** Caused by Rubeola virus. Measles virus is a spherical, nonsegmented, single-stranded, negative-sense RNA virus in the Morbillivirus genus of the Paramyxoviridae family. Measles usually begin with a gentle to adequate fever, which is commonly go along with conjunctivitis, and can linger for two to three days. To avoid acquiring measles, the MMR vaccine can be attempted. The measles, mumps, and rubella vaccinations protect from three diseases. The CDC recommends that children receive two doses of the MMR antibodies, the first at 12 to 15 months of age and the next at Four to six years of age **[15, 16].**

e) **POLIOMYELITIS-** Caused by Poliovirus. Each of the four viral polypeptides—VP1, VP2, VP3, and VP4—can be found in 60 copies within the poliovirus capsid. The icosahedral balance is created by the proteins' strategy in the capsid. The virion's surface is covered in star-shaped plateaus that follow the lines of each of its five tomahawks and are encircled by deep crevasses and three-bladed propellers. The major symptoms of this disease are-

- **Nonparalytic polio:** Some people who acquire poliovirus symptoms catch a variant of polio that does not result in paralysis (abortive polio). This generally causes the same mild, flu-like signs and symptoms as other viral infections. The signs and symptoms can last up to 10 days and include fever, headache, vomiting, and lethargy.
- **Paralytic syndrome:** It is the most severe type of polio and can result in dreadful muscle weakness, loose and wobbly limbs, and reflex loss.
- **Post-polio syndrome:** is a collection of debilitating symptoms that some people experience years after contracting polio. Progression of muscle or joint weakening and discomfort are common indications and symptoms.

Depending on the age of the person, it is administered by a leg or jolt. Various nations use the oral polio vaccine (OPV). The CDC advises that children receive four doses of the polio vaccine **[17].**

In addition, there are also other viral diseases caused by specific virus i.e. Influenza caused by Influenza virus (RNA virus); encephalitis caused by Herpes Simplex Viruses; Mumps caused by Paramyxovirus etc. Viral diseases can be treated in a variety of methods, including proper nutrition, medication for fever, aches and pains, adequate rest, and increased hydration intake.

CONCLUSION

Immunization against viral infections can be active or passive. Active immunity works by encouraging the body's immune system to manufacture its antibodies by vaccination with a viral preparation. Passive immunity is achieved by delivering antibodies produced in another host. Personal hygiene is the most efficient method of avoiding respiratory virus infections.

Wash your hands frequently, keep mouth covered when you sneeze or cough and avoid contact with individuals who are suffering from respiratory symptoms. There is now a vaccine available to help reduce the chances of catching the seasonal flu. Washing your hands often, especially after using the toilet, will help you avoid stomach virus diseases. Keeping surfaces clean and abstaining from sharing personal items or dining utensils may also be useful. Rotavirus vaccination is also recommended as part of a child's immunization regimen.

REFERENCES

1) Woolhouse MEJ, Gaunt E. Ecological origins of novel human pathogens. Crit Rev Microbiol 2007; 33: 1–12.
2) Parrish CR. Molecular epidemiology of parvoviruses. Semin Virol 1995; 6: 415–418.
3) Woolhouse MEJ, Howey R, Gaunt E, Reilly L, Chase-Topping M, Savill N. Temporal trends in the discovery of human viruses. Proc R Soc B 2008; 275: 2111–2115.
4) Kapoor A, et al. A newly identified bocavirus species in human stool. J Infect Dis 2008; 199: 196–200.
5) Antia R, Regoes RR, Koella JC, Bergstrom CT. The role of evolution in the emergence of infectious diseases. Nature 2003; 426: 658–661.
6) King DA, Peckham C, Waage JK, Brownlie J, Woolhouse MEJ. Infectious diseases: preparing for the future. Science 2006; 313: 1392–1393.
7) Morawska L, Johnson GR, Ristovski ZD, Hargreaves M, Mengersen K, Corbett S, Chao CYH, Li D, Katoshevski Y. Size distribution and sites of origin of droplets expelled from the human respiratory tract during expiratory activities. J Aerosol Sci 2009; 40: 256–269.
8) Fabian P, Brain J, Houseman EA, Gern J, Milton DK. Origin of exhaled breath particles from healthy and human rhinovirus-infected subjects. J Aerosol Med Pulm Drug Deliv 2011; 24: 137–147.
9) Abed Y, Baz M, Boivin G. Impact of neuraminidase mutations conferring influenza resistance to neuraminidase inhibitors in the N1 and N2 genetic backgrounds. Antivir Ther 2006; 11: 971–976.
10) Air GM. Influenza neuraminidase. Influenza Other Respir Viruses 2012; 6: 245–256.
11) Baum LG, Paulson JC. The N2 neuraminidase of human influenza virus has acquired substrate specificity complementary to the hemagglutinin receptor specificity. Virology 1991; 180: 10–15.
12) Basak S, Tomana M, Compans RW. Sialic acid is incorporated into influenza hemagglutinin glycoproteins in the absence of viral neuraminidase. Virus Res 1985; 2: 61–68.
13) Barman S, Ali A, Hui EK, Adhikary L, Nayak DP. Transport of viral proteins to the apical membranes and interaction of matrix protein with glycoproteins in the assembly of influenza viruses. Virus Res 2001; 77: 61–69.
14) Goel MK, Goel M, Khanna P, Mittal K. Pandemic influenza A (H1N1) 2009 vaccine: an update. Indian J Med Microbiol 2011; 29:13–8.
15) Gupta SK, Sosler S, Lahariya C. Introduction of Haemophilus influenzae type b (Hib) as pentavalent (DPT-HepB-Hib) vaccine in two States of India. Indian Pediatr 2012; 49:707–9.

16) Brimnes N. Variolation, vaccination and popular resistance in early colonial south India. Med Hist 2004; 48:199–228.
17) Bhattacharya S, Harrison M, Worboys M. Hyderabad: Orient Longman; 2006. Fractured states: Smallpox, public health and vaccination policy in British India, 1800-1947.