



Overview of Human Viral Diseases

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ABSTRACT

The virus is a non-living organism but is a threat most of the time to humans and plants, because as soon as the virus enters into the host body it becomes active and uses the host's body machinery for its replication and then causes acute and severe diseases. It was first discovered by Beijerinck in 1898 and the first viral disease caused in humans was yellow fever and in plants was the Tobacco mosaic virus. The virus is always a hot topic because of the major pandemic it causes. In recent years, since 2019, the world has been fighting a war against COVID-19, which is continuing because of the variations of the virus i.e., the virus genes get mutated. As we studied, a virus hijacks the host body, which in turn affects human evolution. According to a new study, a virus-fighting protein has triggered genetic mutations that have sped up our species' evolution. In history, viral diseases in human evolution have caused many pandemic levels of diseases because there was a great shift from people hunting for food to people using it for trading purposes, which in turn increased the interaction between humans and animals, which facilitates the transmission of zoonotic pathogens (which travels from animal to human) and gives rise to disease like rabies, yellow fever, coronaviruses, influenza and many more.

Key words: virus; human; disease; protein; transmission

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INTRODUCTION

Viral evolution means there are heritable changes genetically due to the accumulation of viruses during their lives, which originate due to environmental changes or due to host immunity. Due to large population sizes and short generation times, viruses can originate and evolve rapidly. Many theories about its nature have been proposed, but scientists have differing perspectives on viruses. With reference to its virus structure, its shape may be a simple or complex one, i.e., helical, cylindrical, spherical, icosahedral, prolate, etc., so these geometric structures of viruses provide stability and structure. In order to estimate the viruses on our planet, it may be that around 10 trillion viruses are there [1, 2]. In other words, it's very difficult to trace the origin of viruses because they don't leave any fossils and show tricks pertaining to making new copies of viruses within the cells and then invading them. Scientists were still studying and searching for the upcoming variations in the viruses due to evolution. So, these viruses may be responsible for causing several diseases, and there is an urgent need for vaccines against these dreadful viruses, which may originate due to evolution. So, the governments of many countries focused on collaboration in terms of research to efficiently work on the development of vaccines. Even with limited data from patients suffering from these viral diseases, high immunogenic responses were observed after infection, with antibody production in response to the spike protein being observed. This data observation suggests that being optimistic about a highly immunogenic vaccine that can induce the production of antibodies of sufficient magnitude and quality to provide protection is warranted. A vaccine, while theoretically providing a high level of protection, can also exacerbate the infection due to low-quality antibodies [3, 4]. Hence, ensuring the conformation of antigens to elicit functional and effective antibodies is important. Traditional recombinant derived proteins, viral vectors (replicating and non-replicating), and nucleic acid content (i.e., DNA and mRNA) approaches are required for vaccine development. Factors like speed, safety, and reactogenicity, the immunogenicity profile with reference to humoral and cellular immunity, durability, the cost of manufacturing, vaccine stability studies, and cold chain requirements are taken into consideration to calculate and signify the efficacy of the vaccine [1-5]. In spite of the long history of viruses, some of them are discussed below-

Influenza virus- The first pandemic viral disease was the 1918 influenza pandemic caused by the H1N1 virus. It was discovered in the United States and is the most lethal virus in human history, infecting one-

third of the world's population. The unique feature of this virus was that its mortality rate was higher in healthy people (20-40-year-age group). At that time there were no vaccines against this virus and no antibiotics to treat the secondary bacterial infection associated with the influenza virus, only precautions like isolation, quarantine, good hygiene, and use of disinfectants can be taken. After many years the researchers and the virus hunters searched for the lost 1918 virus and studied its genome and other features by recreating the virus in highly safe labs to prepare the world for future pandemics [5, 6].

Yellow fever was the first human viral disease caused by a *flavivirus* and is transmitted through infected mosquitoes. The yellow word in yellow fever refers to jaundice that affects some patients, and there are other symptoms like muscle pain, headache, nausea, vomiting, and fatigue. Most of the time, these symptoms go away after 3-4 days, but some patients enter the toxic phase, and the symptoms, such as high fever, return. Several body parts are affected, like the liver and kidneys; however, half of the patients who enter this phase die within 7–10 days. It is difficult to diagnose at an early stage because its symptoms match those of other diseases like malaria and viral hepatitis, but in the late stages, we can test through ELISA. The population of 47 countries in Africa and South America has been affected and spread to other countries by travel. There is no treatment for curing this virus, but it can be prevented by an effective vaccine, and only a single dose is sufficient for lifelong protection. According to the EYE Partnership, by 2026, it is expected that more than 1 billion people will be protected against this disease [7, 8].

HIV (Human Immunodeficiency Virus) is a lentivirus that causes AIDS, a condition in which the immune system fails, resulting in infections and cancer-like diseases. It is a very dangerous virus because the human body cannot get rid of it. It was first reported in chimpanzees in West Africa and then transmitted to humans by hunting them for meat. It belongs to the family *Retroviridae* and has species like HIV1 and HIV2, but HIV1 has spread more rapidly than HIV2. Its genetic material consists of two small single strands of positive RNA enclosed by a capsid. It can spread from human to human through blood, vaginal fluid, sexual contact, organ transplantation, and from an infected mother to her baby, but it cannot spread through air or water. They attack CD4 receptor cells, which in turn decreases the count of CD4 cells, and the ratio of CD4 over CD8 is reversed in the body. Because infected CD4 cells do not produce the normal amount of interferons and lymphokines, a person's immune system suffers. It can be diagnosed through ELISA and PCR. There are no vaccinations or treatments for HIV; we can only take precautions by having knowledge about sexual practices, avoiding drugs, and using sterile needles and syringes [9, 10].

Coronavirus has been a hot topic and lethal virus since 2019 and has yet to go away. The main reason for this is that it spreads through air droplets. It is an infectious disease caused by SARS-CoV-2, a group of SS-positive RNA viruses that cause diseases in mammals and birds that can range from mild to lethal. Symptoms include fever, cough, tiredness, loss of taste, difficulty breathing, headache, and diarrhoea. Some people will get mild illnesses like the common cold and cough, which can be recovered without special treatment, whereas others will become seriously ill, especially older people and people with weak immune systems due to medical conditions like diabetes, respiratory diseases, or cancer. The coronavirus was first reported in chickens in the United States in 1931; in 1933, the causative agent was identified as a virus, and it is still mutating and causing infections in humans today. On December 31, 2019, WHO was informed about the cases of pneumonia of unknown cause in Wuhan, China. Then on January 7, 2020, they identified the causative agent as a coronavirus, which was a new strain that had never been reported in the human history of the disease. On January 30, 2020, the WHO director-general promulgate the coronavirus explosion or eruption a public health emergency of international concern because it had spread worldwide, with 98 cases and no deaths in 18 countries to 216 countries, and 9 million people were affected because of the novelty of the virus. Because there was no vaccine at that time, only precautions like quarantine, good hygiene, and maintaining social distance could protect the people. Scientists, industries, and other organisations have worked together to complete the vaccine development and to compete against the virus. By December 2020, over 270 divergent COVID-19 vaccines were in prompt expansion, and over 50 of these were in clinical trials. After some time, different vaccines were made by countries, such as Covaxin, which was India's first vaccine, and also others like Covishield, Moderna, Sputnik, etc. Initially, most COVID-19 vaccines were two doses, but immunity after getting the vaccine waned over time, requiring people to get booster doses to maintain immunity against COVID-19 [11, 12].

Rabies is an acute, rapid, and progressive viral disease of the CNS that is caused by a deadly, bullet-shaped neurotropic virus belonging to the family *Rhabdoviridae*. It is not only about dogs but also cats, bats, foxes, and other warm-blooded animals. Animal-to-human interaction will include Rabid animals can transmit rabies to humans either by bite or by saliva, whereas human-to-human interaction is very rare. The rabies virus can be of two types: the street virus and the fixed virus. The street virus is a

naturally occurring virus found in the saliva of infected animals and produces Negri bodies, whereas the fixed virus is prepared by repeated culture in the brain of a rabbit and does not produce Negri bodies. Its exposure time is from 20 to 90 days, and it shows symptoms like fever, headache, vomiting, anxiety, and agitation pain at the site of exposure. Confirmatory tests, such as isolating the virus from saliva and other secretions, or antigen detection via immunofluorescence, can be used to make the diagnosis. Vaccines, for example, were developed by Louis Pasteur and Emile Roux in 1865, and since then, many vaccines have been developed by various researchers and scientists, including the nervous tissue vaccine (which has been banned in India since 2004), the suckling mouse brain vaccine, the purified duck embryo vaccine, and many others. Because the virus is present in the saliva, vomit, tears, and other body fluids of rabies patients, health personnel must wear masks, gloves, goggles, and aprons. Persons with bruises, cuts, or open wounds should not look after the patient [13, 14].

Hepatitis is a broad term that means inflammation of the liver, which is liver damage. It is mostly caused by viruses but can also be caused by drugs, alcohol, and autoimmune diseases. What exactly happens is that when the hepatitis virus enters the body, it travels to the liver and enters the liver cells, where it begins to replicate and increase their number. Common symptoms of this virus are fever, fatigue, joint pain, nausea, jaundice, and dark urine. Viral hepatitis was a major public health concern because 10 million cases were reported back then. Hepatitis can be acute or chronic. There are mainly 5 types of viral hepatitis that are of great concern because of the deaths and epidemics they cause Hepatitis A (HAV), Hepatitis B (HBV), Hepatitis C (HCV), Hepatitis D (HDV), Hepatitis E (HEV) (Table 1). Of all these types, only HAV and HAE cause acute or short-term infections, whereas HBV, HCV, and HDV cause chronic infections, and only HBV is a DNA virus; the rest of the types are RNA viruses. In India, there was a high-level occurrence of hepatitis A. As we studied earlier, viral hepatitis is caused by an infection with a virus. In developed countries, hepatitis A, B, and C viruses cause about 90% of acute hepatitis cases, whereas hepatitis D and E viruses are also responsible for hepatitis. Non-viral hepatitis is mainly caused by the ingestion of products that are toxic to the liver (alcohol, drugs, toxic chemicals, etc.) [15, 16].

Table 1. Hepatitis, prevention and treatment

Type	Source	How it spreads	Prevention	Treatment
Hepatitis A	Faeces	Contaminated food and water	Improved hygiene Vaccination	No available treatment
Hepatitis B	Blood/blood-derived body fluid	Contact with infected body fluids	Blood screening Improved hygiene Vaccination	Nucleoside analogs pegylated interferon
Hepatitis C	Blood/blood-derived body fluid	Drug use and non-sterilized medical	Blood screening Sterile needles for drug injections	Direct-acting antiviral agents
Hepatitis D	Blood/blood-derived body fluid	Contact with infected blood	Blood screening Sterile needles for drug injections Practice safe sex	It can be treated with interferon
Hepatitis E	Feces	Blood-to-blood contact, unsafe sex, and childbirth	Improved hygiene Avoid uncooked fruits or vegetables	Benefit from using ribavirin

CONCLUSION

Scientists were still studying and searching for the upcoming variations in the viruses due to evolution. In short, availability of several approved vaccines are reported worldwide and showed its effectiveness in order to reduce the burden of infection to some extent. In other words, vaccinating more and more people will be key pertaining to achieve immunity against these infectious diseases.

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