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Immune System to Produce Protective Antibodies

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Introduction

Poliovirus is a highly contagious virus that primarily affects young children and can cause paralysis, permanent disability, and even death. In the mid-20th century, polio epidemics swept across the world, causing widespread panic and suffering. However, thanks to the development of effective vaccines, polio has been largely eradicated from the world, with only a few remaining cases reported in a handful of countries. In this article, we will explore the molecular biology of the poliovirus and how vaccines work to elicit an immune response to protect against it. Poliovirus is a single-stranded RNA virus belonging to the Picornaviridae family. It has a non-enveloped icosahedral capsid containing 60 copies each of four structural proteins VP1, VP2, VP3 and VP4. The genome of the poliovirus is encodes a single polyprotein that is cleaved into various functional proteins by viral and host proteases [1].

Description

The poliovirus replicates in the cytoplasm of infected cells, using the host cell machinery to translate its RNA into viral proteins. The viral RNA is also used as a template for replication, with new virus particles assembled and released from the infected cell. Poliovirus can infect the gastrointestinal tract, where it can cause a mild illness resembling the flu. However, in some cases, the virus can enter the nervous system, where it can cause paralysis and other serious complications. The precise mechanisms by which poliovirus causes paralysis are not fully understood, but it is thought to involve the destruction of motor neurons in the spinal cord and brainstem. There are two types of poliovirus vaccines currently in use: inactivated poliovirus vaccine and oral poliovirus vaccine. IPV is a killed virus vaccine that is given by injection. It contains purified and inactivated poliovirus that cannot cause disease but can still elicit an immune response. IPV was first developed in the 1950s and was widely used in developed countries to control polio epidemics [2].

OPV is a live attenuated virus vaccine that is given orally. It contains weakened poliovirus that can still replicate in the gut but is unable to cause disease in most people. OPV was developed in the 1960s and was used extensively in developing countries to control polio epidemics due to its low cost and ease of administration. Both IPV and OPV have been highly effective in controlling polio, with the number of cases worldwide dropping from millions in the 1950s to just a handful today. However, both vaccines have some limitations and risks. IPV provides excellent protection against paralytic polio but may not provide complete protection against non-paralytic polio or against the spread of the virus from person to person. OPV provides good protection against all forms of polio and can also help to stop the spread of the virus by inducing intestinal immunity, but it carries a small risk of causing vaccine-associated paralytic polio. VAPP occurs when the attenuated virus in the vaccine mutates and regains its ability to cause disease, leading to paralysis in some vaccine recipients [3].

Due to the risks associated with OPV, many countries have switched to IPV-only vaccination schedules, particularly in areas where polio has been eradicated. However, OPV is still used in some developing countries where the risk of wild poliovirus transmission is higher, and efforts are underway to develop safer OPV strains that do not cause VAPP. Poliovirus is a highly infectious viral pathogen that causes poliomyelitis, a severe disease that affects the nervous system and can lead to permanent paralysis. Poliomyelitis was once a major global health problem, but vaccination efforts have drastically reduced the incidence of the disease. Poliovirus vaccines are designed to stimulate the immune system to produce protective antibodies that can neutralize the virus and prevent infection. In this article, we will discuss the molecular biology of poliovirus and the immune response to poliovirus vaccines. Poliovirus is a member of the Picornaviridae family, which also includes other human pathogens such as coxsackievirus, rhinovirus, and hepatitis A virus. The virion is a small, non-enveloped particle that consists of a single-stranded, positive-sense RNA genome of approximately 7,500 nucleotides [4].

The genome is organized into a single open reading frame that encodes a polyprotein of approximately 2,200 amino acids. The polyprotein is cleaved into individual viral proteins by viral and host proteases. The poliovirus genome is translated into a single polyprotein, which is then cleaved into three structural proteins and seven non-structural proteins. The structural proteins form the viral capsid, which surrounds the viral genome and protects it from host defenses. The non-structural proteins are involved in viral replication and the modulation of host cell processes. Poliovirus enters host cells by binding to a specific receptor on the cell surface, called the poliovirus receptor. The PVR is a type I transmembrane protein that is expressed on the surface of a wide variety of human cells. After binding to the PVR, the virion is internalized by endocytosis and the viral genome is released into the host cell cytoplasm. Once inside the host cell, the poliovirus genome is translated into the viral polyprotein, which is then cleaved into individual viral proteins by viral and host proteases. The non-structural proteins are involved in the replication of the viral genome, while the structural proteins form the viral capsid. The viral genome is replicated through a process of negative-strand synthesis, in which the positive-sense RNA genome serves as a template for the production of complementary negative-sense RNA molecules. The negative-sense RNA molecules are then used as templates for the production of new positive-sense RNA genomes [5].

Conclusion

Poliovirus vaccines are designed to stimulate the immune system to produce protective antibodies against the virus. The first poliovirus vaccine was developed by Jonas Salk in 1955 and was based on inactivated poliovirus. This vaccine, known as IPV, consists of a mixture of all three poliovirus serotypes that have been inactivated with formalin. IPV is administered by injection and requires multiple doses to achieve full protection. The second type of poliovirus vaccine is the oral poliovirus vaccine, which was developed. OPV consists of live, attenuated poliovirus strains that can replicate in the human intestine but are unable to cause disease. OPV is administered orally and provides long-lasting immunity after a few doses. Both IPV and OPV induce an immune response against the viral capsid proteins that are exposed on the surface of the virion. These proteins are highly immunogenic and are able to stimulate the production of neutralizing antibodies that can prevent viral.

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Conflict of Interest

None.

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