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Smallpox Infectious Disease

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A right hand with open smallpox sores.

A baby infected with the smallpox disease.

Smallpox Background

Microorganism:

Smallpox is a disease similar to chicken pox, but not exactly the same. Smallpox is caused by a virus called Variola and is a member of the genus orthopoxvirus. The virus is a large brick shaped DNA virus. Smallpox spreads by direct, face to face contact with an infected person or by contact with infected body fluids or contaminated objects such as clothing. Smallpox is rarely spread through airborne transmission and is not known to be transmitted by animals or insects. The incubation period lasts from 7 to 17 days, during which infected individuals often show no symptoms and are not contagious. The lifecycle of poxviruses is complicated by having multiple infectious forms, with differing mechanisms of cell entry. Smallpox reproduces in a unique way among DNA viruses in that they replicate in the cytoplasm of the cell rather than in the nucleus. In order to replicate smallpox produce a variety of specialized proteins not produced by other DNA viruses, the most important of which is a viral-associated DNA-dependent RNA polymerase (CDC, 2004).

Importance:

Smallpox is a serious and contagious disease that can sometimes be fatal. In the 20th century alone, an estimated 300 million people died from this disease. There is no cure for smallpox, only a vaccination to prevent it. If you get the vaccination for smallpox, your body should be immune to the smallpox disease (CDC, 2004).

Historical:

There have been several cases of smallpox outbreaks in the world. In 1545, the first outbreak of this disease was in India, where it killed some 8,000 children. In 1633, smallpox spread through the colony of Massachusetts, affecting both settlers and Native Americans. This outbreak killed 20 settlers from the Mayflower, and one of the settlers who died was their only physician. In 1721, an epidemic occurred in Boston, resulting in 844 deaths. Smallpox was completely eradicated from the world by the 1980s (College of Physicians of Philadelphia, 2015).

Smallpox Infection

Immune Response:

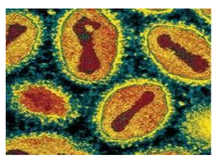
When viruses enter the bloodstream, the immune system usually produces a substance called interferon-gamma. The interferon-gamma helps the body fight off disease and stops viral replication. However, when the smallpox virus enters the bloodstream, it contains a "weapon" to invade the immune system. This weapon is called an interferon-gamma binding protein. This protein binds with the interferon-gamma and immobilizes it, making the substance no longer able to activate the immune defenses. The smallpox virus then replicates and can cause extensive damage. The smallpox virus is also known to have a complementary regulatory protein. This protein inactivates the complementary system, so the host cell is not targeted by the mediated attack of the immune system. The virus enters through the mouth and the throat and successfully evades the first line of defense. The virus then enters a host cell so the virus can replicate. The second line of defense sends white blood cells to find the virus and destroy it; however, the virus in already in a cell, hidden from b-cells. The third line of defense is activated, but smallpox has a specialized protein that binds with the interferon-gamma, making the body think that everything is going properly (Saint Louis University, 2008).

Progression:

After the initial symptoms an early rash begins to form (lasts about 4 days) and smallpox sometimes contagious during this phase. A pustular rash is next (lasts about 5 days) and is contagious. During the third stage/phase pustules and scabs forms (lasts about 5 days) and is very contagious. Finally resolving scabs (last about 6 days) and is not contagious. There is no treatment option that kills the small pox virus, but here are some treatments to relieve the symptoms. Intravenous (IV) fluids, medications to control fever, or pain antibiotics to prevent secondary infections from bacteria (CDC, 2007).

Prognosis:

Smallpox has a fatality rate of 30%. Normally smallpox is chronic; people who do get smallpox do not die. After a couple of weeks, the smallpox virus should be out of the body completely and symptoms and rashes will no longer be evident. There is no recurrence, because memory cells remember the virus to stop it immediately next time (CDC, 2004).



The Variola Virus

Rash at each stage of Development

The Smallpox Vaccine

Woman getting treated with the Smallpox disease

Smallpox Treatment

Options:

There is no treatment for the smallpox virus, only a vaccine to prevent it. There are also ways to help manage the symptoms of this virus. The Intravenous (IV) fluids, pain antibiotics to relieve pain and to prevent secondary infections from bacteria, and medications to control fever, are the ways to help treat the symptoms of this virus (Donaldson, Kramer, and Lim, 2004).

Mechanism:

The smallpox vaccine (vaccina virus) is the only known way to prevent this disease. This vaccine contains the live smallpox virus to help the body become immune to this disease. Four or five days after receiving the vaccine, a red and itchy bump appears at the vaccination site. At this point, the rash is contagious. A week after the vaccination, the bump becomes a blister and fills with pus. In the second week, the blister develops into a scab. In the third week, the scab eventually falls off, making the disease no longer contagious. The live virus injected to help the B memory and killer T cells help remember this virus the next time it appears (Donaldson, Kramer and Lim, 2004).

Emerging:

Scientists and doctors are trying to develop a new drug or treatment for the smallpox disease. The smallpox virus contains a harmful interferon-gamma binding protein. The interferon-gamma binding protein binds with the interferon-gamma, stopping the good protein form binding with the substance, and eventually helps spread the smallpox disease. Since the interferon-gamma binding protein is harmful, scientists are developing a drug to help stop the binding between the good interferon-gamma and the harmful protein (Donaldson, Kramer and Lim, 2004).

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References available upon request.