
Infectious disease: Smallpox Vaccine

Smallpox is a highly infectious disease with a mortality rate of 30% which is caused by a poxvirus known as variola. This is the most virulent member of the genus Orthopoxvirus. The origins of smallpox are unknown but evidence of infection was found in 3000 year old Egyptian mummies including that of the the Pharoah Ramses V dating back to 1157 BC.

There are two forms of the variola virus: variola major and variola minor. Variola major is the more common and lethal strain, producing more severe symptoms and accounting for approximately 30% of deaths while the milder form only accounts for less than 1% of deaths. In order to infect an individual, the virus must first attach itself to a host since viruses are only able to replicate inside the living cells of other organisms. This is normally in the mouth, trachea or lung mucosa and the virus enters the cell via endocytosis.

The cytoplasm of the host cell is the site of variola replication. Since the virus contains the necessary enzymes, DNA replication and transcription can occur immediately. During translation, the proteins which form the structure of the virion and proteins which bind to molecules of the immune system are made. By fusing with the host cell-surface membrane, the mature virion exits the host cell to infect others. In the process, it increases the chance of cell degradation since the fusion proteins acts as virulence factors which harm the host.

Due to excessive quantities of viral mRNA, it inhibits the transcription and translation of proteins within the host, ultimately resulting in cell death. The disease is transmitted from person to person in the form of virus-contaminated air droplets when infected people cough, talk or sneeze. In fatal cases, the disease can lead to further malignant diseases including intravascular coagulation or bleeding of the skin and intestinal tract. Smallpox was not only the first infectious disease affecting humans to be eradicated but was also the first disease for which a vaccine was created. The English physician, Edward Jenner is often regarded as the “father of modern immunology” following his discovery of a vaccine for smallpox.

In 1796, he noticed that milkmaids exposed to cowpox, a disease caused by a virus similar to variola that affects cows, did not contract smallpox. He inoculated an eight year old boy with a vaccine containing live cow pox and the boy did not get smallpox. Jenner’s work represented the first scientific attempt to control an infectious disease by the deliberate use of the newly developed “vaccinia” vaccine.