

Family: Poxviridae (Human Pox disease)

Poxviruses are the largest and most complex of viruses infecting humans. The family encompasses a large group of agents that are similar morphologically and share a common nucleoprotein antigen. Infections with most poxviruses are characterized by a rash, although lesions induced by some members of the family are markedly proliferative. The group includes variola virus, the etiologic agent of smallpox—a viral disease that has affected humans throughout recorded history.

Structure and Composition:

Virion: Complex structure, large, oval or brick shaped, 300–400 nm in length × 230 nm in diameter; external surface shows ridges contains core and lateral bodies.

Genome: Double-stranded DNA, linear.

Envelope: Virion assembly involves formation of multiple membranes.

Outstanding characteristics: Large and complex viruses; very resistant to inactivation.

Virus-encoded proteins help evade host immune defense system.

Smallpox was the first viral disease eradicated from the world.

Classification

Poxviruses are divided into two subfamilies based on whether they infect vertebrate or insect hosts. The vertebrate poxviruses fall into nine genera, with the members of a given genus displaying similar morphology and host range as well as some antigenic relatedness. Most of the poxviruses that can cause disease in humans are contained in the genera:

1. *Orthopoxvirus*
2. *Parapoxvirus*

The orthopoxviruses have a broad host range affecting several vertebrates. They include ectromelia (mousepox), camelpox, cowpox, monkeypox, vaccinia, and variola (smallpox) viruses. The last four are infectious for humans. Vaccinia virus differs only in minor morphologic respects from variola and cowpox viruses.

Poxvirus infections in humans:

Variola: Smallpox (now eliminated)

Vaccinia: Localized lesion; used for smallpox vaccination

Pathogenesis and Pathology of Smallpox

Disease: smallpox. Although smallpox has been eradicated, the pathogenesis of the disease illustrated by:

The portal of entry of variola virus was the mucous membranes of the upper respiratory tract, after viral entry:

- (1) primary multiplication in the lymphoid tissue draining the site of entry.
- (2) transient viremia and infection of reticuloendothelial cells throughout the body.
- (3) a secondary phase of multiplication in those cells, leading to (4) a secondary, more intense viremia; and (5) the clinical disease.

By the sixth to ninth day, lesions in the mouth tended to ulcerate and discharge virus. Thus, early in the disease, infectious virus originated in lesions in the mouth and upper respiratory tract. Later, pustules broke down and discharged virus into the environment of the smallpox patient. All of the layers of the skin were involved, and there was actual necrosis, thus, scarring occurred after variola infection.

Clinical Findings

The incubation period of variola (smallpox) was 10–14 days. The onset was usually sudden. One to 5 days of fever and malaise preceded the appearance of the exanthems, which began as macules, then papules, then vesicles, and finally pustules. These formed crusts that fell off after about 2 weeks, leaving pink scars that faded slowly.

Isolation and identification of Virus

Skin lesions are the specimen of choice for viral detection and isolation. Poxviruses are stable and remain viable in specimens for weeks even without refrigeration.

1. Direct examination of clinical material in the electron microscope is used for rapid identification of virus particles and can readily differentiate a poxvirus infection from chickenpox (that caused by a herpesvirus).
2. Polymerase chain reaction (PCR) tests.

3. Viral antigen can be detected by immunohistochemistry in tissues and in material collected from skin lesions.
4. Cell cultures can be used for virus isolation.

Treatment

Vaccinia immune globulin is prepared from blood from persons vaccinated with the vacciniavirus. An attack of smallpox gave complete protection against reinfection. Vaccination with vaccinia induced immunity against variola virus.

Vaccination will be done between 1 and 2 years of age is preferable to vaccinating in the first year of life. Revaccination has been done at 3-year intervals.

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