

Herpes simplex virus

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It was the first human herpes virus to be discovered. The word herpes is derived from a Greek verb meaning to creep. Herpes simplex is actually a genus comprising two types of herpes viruses: **HSV-1 and HSV-2**. Both have similar structures, and antigenic determinants, but cause infections in different parts of the body. HSV-1 is usually transmitted through saliva and causes oropharyngeal infections. HSV-2 is transmitted sexually or from mother to newborn at birth. Another characteristic of this group is that these viruses can stay in a **latent phase**, in which the virus does not multiply and remains in the dorsal root ganglia. During reactivation, the virus travels through sensory nerves from the ganglia back to the site of **primary infection**, where it again causes disease.

Structure

Characteristic morphological features are typical for this group. These viruses contain in their capsid envelope a **linear double-stranded DNA molecule** of 125 to 248 kbp^[1]. The genes encode approximately **80 proteins**^[2]. However, only 40 of these are involved in viral replication. The rest interact with the host cell and the immune system. The HSV genome encodes DNA-dependent DNA polymerase, deoxyribonuclease, thymidine kinase, ribonucleotide reductase and protease. The DNA is surrounded by a capsid consisting of 162 hollow hexagonal and pentagonal capsomeres.^[1]

When the viral particle is mature, the capsid is surrounded by a lipid envelope that originates from the nucleus of the host cell. **Glycoproteins** that are encoded by the virus itself protrude from the lipid envelope. **Glycoproteins gB and gD** serve to capture and enter the potential host cell. **Glycoprotein gH** then allows the virion to be released within the cell.

Replication

HSV can **infect most cells** in the human body. The virus attaches to the cell and fuses with the cell membrane. Its virion then enters the cytoplasm and travels to the nucleus. First, the so-called **DNA-binding proteins** are transcribed, which stimulate DNA synthesis and which initiate the transcription of early viral genes. Early proteins include DNA-dependent DNA polymerase and thymidine kinase. Other viral proteins then suppress the production and even **initiate the degradation of cellular mRNA and DNA**. Viral glycoproteins are produced in the Golgi apparatus and are incorporated into the cell membrane. New mature viral particles leave the host cell by exocytosis, intercellular junctions between cells or during host cell lysis. Infected cells usually do not survive such an attack and undergo necrosis.

Diseases

HSV-1 and HSV-2 are common human pathogens that cause **painful and recurrent disease**. Usually, the course of the disease is mild, but this is not always the case. The manifestation varies and depends on many factors, the most important of which is the **state of the immune system**. The infection may present in a milder form as herpes labialis or herpes genitalis, or as life-threatening **herpetic encephalitis**. Caution should be taken with ongoing infections in children and in immunosuppressed patients. In them, infections of the eye or brain can cause serious complications and even death. There is currently **no effective vaccine to prevent HSV-1 or HSV-2 infection**.

The virus may be the causative agent of:

- skin infections,
- lip infections,
- eye infections,
- CNS infections - encephalitis and meningitis,
- genital infections,
- neonatal infections.

Skin infections

Infections in the hand area are quite common. If they appear, then they are white in color, painful, but do not form typical sores. They are often associated with lymphatitis. **Eczema herpeticum** is a serious form. The disease resembles chickenpox. Extensive ulceration occurs due to protein loss and dehydration. The spread of the disease has fatal consequences.

Infections in the mouth area



Infection in the lip area

They are caused by both **HSV-1 and HSV-2**. Commonly, the infection manifests itself as **acute, febrile gingivostomatitis** in preschoolers. Fluid-filled boils occur fairly quickly around the lips and the surrounding area. Children heal within 7-10 days. In older patients, this disease often occurs together with mononucleosis, often during pregnancy, in newborn babies or immunosuppressed patients.

Eye infections

These are mainly caused by **HSV-1**, which can be transmitted to the eye manually during a cold or during a primary infection in childhood. It may present as **conjunctivitis or keratoconjunctivitis** with corneal ulcerations. Recurrent ocular infection may progress to epithelial keratitis, which is characterised by reduced corneal sensitivity. Disease caused by HSV tends to recur, especially in patients over 50 years of age.^[1]

Untreated infections can lead to **loss of vision**.

CNS infections

HSV-2 infection manifests as **serous meningitis**. It is most often encountered in neonates of mothers with acute blistering, after passing through the birth canal. The clinical picture is identical to other viral meningitis.

HSV-1 causes **acute hemorrhagic-necrotizing encephalitis** with a severe course and very poor prognosis (lethality 30%, up to 70% in untreated patients). Approximately 30% of cases of HSV encephalitis occur in patients under 20 years of age, and 50% of cases occur in patients over 50 years of age^[3]. It spreads retrogradely from the trigeminal ganglia, most commonly affecting the frontotemporal region of the brain.

It starts as a non-specific headache with fever, and progresses to seizures along with a qualitative and quantitative impairment of consciousness. Hallucinations, behavioural and memory disturbances, aphasia and signs of cerebral oedema are common. Even with early treatment, there are often permanent consequences (most often a memory disorder).

See Encephalitis caused by herpes simplex viruses for more information .

See Viral Meningitis for more information

Genital infections

Both HSV-1 and HSV-2 can cause infection in the genital area. These infections are most common in **sexually active individuals**. It is more severe in women than in men. The incubation period is approximately **2-20 days**. The infection is accompanied by **fever, nausea, malaise, urethritis and vaginal discharge**. The local lymph nodes are enlarged. Local symptoms resolve after approximately 2 weeks. However, the virus latently infects the nerve endings, may reactivate and travel back along the nerves to the original site, where it causes **recurrent genital herpes**. Secondary **mycotic or bacterial infections** are also common. Complete cure may take several weeks for an untreated infection. **Aseptic meningitis** may also develop in more than 10% of those affected by primary infection.^[4]



Infections in the eye area



Genital herpes

Neonatal infections

They are relatively rare, but **very dangerous**. More than 60% of infected newborns suffer severe damage to the body. Infection is **most commonly caused by HSV-2**, which affects the newborn as they pass through the birth canal. The disease may or may not present with a skin rash. In most cases, a generalized infection becomes apparent around **5th day of postnatal life**. Once the virus begins to spread, it causes **fever, lack of appetite, irritability and sepsis**. **Pneumonia or jaundice** may occur. Progressive liver failure with coagulopathy leads to death of the newborn around day 16. It is necessary to intervene fairly quickly with antiviral therapy and to monitor the newborn for the occurrence of a rash. Parenteral administration of acyclovir every 8 hours to newborns can **reduce mortality** to 29% for disseminated infection and 4% for CNS infection.

You can find more detailed information on the Adnate HSV infection page

Diagnosis and treatment

The presence of the viral DNA can be detected in fluid from blisters, saliva, conjunctival sacs, cerebrospinal fluid. Cultivation on tissue structures are gradually being replaced by molecular methods, where we can distinguish HSV-1 from HSV-2. **Acyclovir, valacyclovir and famciclovir** are used for the treatment of severe and early infections. If the patient is in a serious condition, we can also administer acyclovir intravenously. Repeated attacks are difficult to treat, patients should take prophylactic **antivirals at prodromal symptoms**.^[3]

References

Related articles

- Herpesviruses
- Herpes zoster
- Varicella-zoster virus
- Encephalitis caused by herpes simplex viruses
- Adnate HSV infection
- Viral meningitis
- Gingivostomatitis herpetica
- Antivirals

External links

- Herpes - video by Osmosis (YouTube video in English with English subtitles) (<https://www.youtube.com/watch?v=IxLhUDI3z60>)

References

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2. MURRAY, Patrick R a Ken S ROSENTHAL. *Medical microbiology*. 5. vydání. Philadelphia : Elsevier Mosby, 2005. ISBN 0-323-03303-2.
3. GOERING, Richard V a Hazel M DOCKRELL. *Mimsova lékařská mikrobiologie*. 5. vydání. Praha : Triton, 2016. 568 s. ISBN 978-80-7387-928-0.
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