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Epstein-Barr Virus: Biology, Clinical Manifestations and Prevention

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Annotation: This article focuses on the biology of the Epstein-Barr virus (EBV), its clinical manifestations in the oral cavity, and preventive measures. Based on the analysis of modern scientific literature, the contagiousness of the virus, clinical manifestations of the infection, its effect on the immune system, and the risk to health are considered. EBV infection is often asymptomatic, but in some cases, enlargement of the lymph nodes, sore throat, fatigue, and fever are observed. The results of the article emphasize the importance of early detection of the virus and preventive measures, and also remind that this data is not intended for personalized treatment.

Keywords: Epstein-Barr virus, infection, oral cavity, clinical manifestations, immune system, prevention.

Input

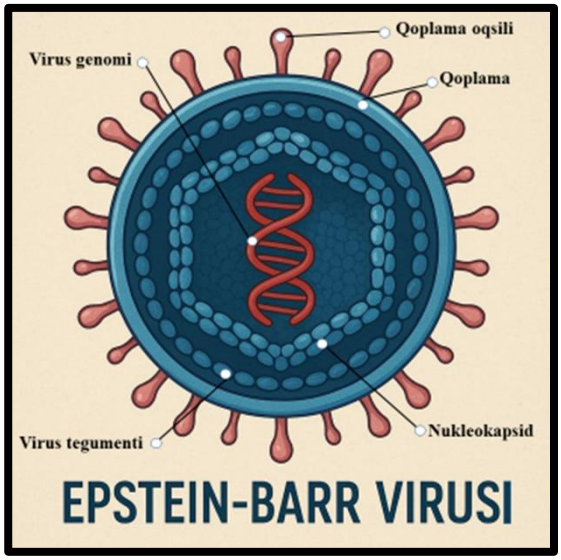
The Epstein-Barr virus (EBV) is found in many people and persists in the infected human body throughout life, serving as a stimulating factor for various diseases. HIV is a very common source of contagious infection among humans. Almost 95% of adults worldwide are infected with EBV, however, there is insufficient information among the general population about the biological and clinical features of the virus. The study of the Epstein-Barr virus is of great importance in the field of medicine, since, although it is often in a latent (sleeping) state, it is activated by a decrease in immunity and can cause the development of various dangerous diseases, including oncological ones. In most cases, primary contact with HIV occurs during the first decade of life and causes persistent (continuous) infection. In early childhood, infection usually proceeds asymptomatically or with very little symptoms.

The Epstein-Barr virus can infect various cell types, including B-lymphocytes (a type of white blood cell) in the immune system and epithelial cells of mucous membranes. The virus is transmitted from person to person through biological fluids, mainly through saliva (hence it is also called "kiss disease"), and rarely through blood or sexual contact. EBV belongs to the gamma-herpesvirus family and is a type of DNA-containing virus. It is also known as Human herpesvirus 4 (HHV-4) or Lymphocryptovirus. EBV was first identified in 1964 by British virologist Professor Michael Epstein and his graduate student Ivonna Barr and thus received its name. This discovery is of great importance in the fields of virology and oncology.

The purpose of this article is to analyze the biology of the virus, clinical manifestations in the oral cavity, and preventive measures.

Main part

The Epstein-Barr virus (EBV) genome consists of approximately 170-180 thousand nucleotide pairs and is made up of double-stranded DNA. EBV, like other herpesviruses, has a complex structure. Viral DNA is enclosed by a special protein shell - a capsid. The capsid consists of 162 capsomeres, which protect DNA. Outside the capsid is a protein layer called the tegument. The outermost part is the supercapsid, which contains glycoprotein ceilings that allow the virus to bind to the cell.



Main parts of the EBV virion:

1. Genome (DNA): A two-stranded linear DNA molecule containing viral genetic information.

2. Nucleocapsid: consists of DNA (nucleoid) and its surrounding capsid. The capsid has a 20-sided shape and consists of 162 proteins (capsomeres).

3. Tegument: The protein layer located between the nucleocapsid and the outer shell.

4. Supercapsid: Two-layered outer shell. It has lipid, polyamine, and glycoprotein ceilings. The tips allow the virus to attach to receptors on the cell surface.

The Epstein-Barr virus damages pharyngeal epithelial cells and B-lymphocytes. This virus remains in the body of an infected person for life, but is often in a latent state. EBV can be activated when immunity is lost and can trigger other oncological diseases.

If primary infection with EBV occurs between the ages of 10 and 20, respiratory tract infections are observed in approximately 40% of patients. Infectious mononucleosis is also detected in 18-25% of patients. Primary infection with the Epstein-Barr virus (EBV) - clinical signs of infectious mononucleosis: Hyperthermia (high body temperature), pharyngeal pain (severe sore throat), asthenic syndrome (fast fatigue, general weakness), lymphadenopathy (enlargement of lymph nodes, especially in the neck), splenomegaly and hepatomegaly (enlargement of the spleen and liver). Additional symptoms: headache, general malaise, exanthema, and in some cases, jaundice syndrome (yellowing of the skin and mucous membranes).

Main clinical symptoms:

- Fever: accompanied by a rise in body temperature, often accompanied by chills.
- Pharyngeal sore'nausea: inflammation and pain in the throat (pharyngitis), often accompanied by a purulent coating in the tonsils.
- Lymphadenopathy: swelling and enlargement of lymph nodes, predominantly in the cervical region.
- Asthenic syndrome: severe fatigue and decreased energy, can last for several weeks or even months.
- Spleno- and hepatomegaly: in some cases, enlargement of the spleen and liver is observed**.**

The asymptomatic course of the Epstein-Barr virus (EBV) in children is a common condition, especially at an early age. In such a situation, the child's immune system effectively suppresses the virus, and the infection manifests without clinical signs or with minimal symptoms (for example, mild discomfort, short-term fever). Nevertheless, EBV persists in the body for life and can be reactivated in the future. Unlike young children, HIV infection in adolescents and adults often leads to the development of infectious mononucleosis.

Complications of Epstein-Barr virus (EBV) infection include damage to various organs and systems:

- Cardiovascular system: myocarditis, pericarditis, vasculitis.
- Nervous system: meningitis, encephalitis, myelitis, Guillain-Barré syndrome, multiple sclerosis.
- Blood system: thrombocytopenia (decreased platelet count), anemia.
- Liver and spleen: hepatitis, spleen rupture.

Long-term complications:

- Oncological diseases: Burkitt's lymphoma, Hodgkin's lymphoma, nasopharyngeal carcinoma, stomach carcinoma.
- Autoimmune diseases: systemic lupus erythematosus (SLE), rheumatoid arthritis, multiple sclerosis.
- Chronic EBV infection: chronic lymphadenopathy, fatigue syndrome, immune system disorders
- The Epstein-Barr virus is transmitted in the following ways:
- Contact household route - saliva, use of common dishes, kissing
- Airborne droplet - in cough or sneezing
- Sexual route - through sexual intercourse
- Blood-through - hemotransfusion route (in blood transfusion)
- Transplantation from mother to child

The Epstein-Barr virus multiplies in B-lymphocytes and epithelial cells, therefore the clinical manifestations of this pathology are characterized by variability. An important distinguishing feature of virusing is that it does not stop or disrupt the proliferation of B-lymphocytes, but, on the contrary, stimulates it. This demonstrates the specificity of the pathogen - it multiplies in immune system cells, forcing them to clone their viral DNA.

The study of EBV began in 1964. Michael Epstein and Yvonne (Ivonna) Barr identified the virus in a culture of Burkitt lymphoma cells, hence the virus is named after them. The discovery was made at a research institute in London. Subsequently, research was directed towards oncology, as EBV was recognized as one of the first oncogenic viruses identified in humans - opening a new era in the possibility of viruses playing a role in the development of cancer. Subsequently, the association of EBV infection with infectious mononucleosis was established; hematological analyses showed characteristic changes in the blood during the disease, which was called infectious mononucleosis. It is known that clinical manifestations similar to infectious mononucleosis have been described since the beginning of the 19th century and were also specifically noted in 1920.

The Epstein-Barr virus plays an important role not only as a causative agent of infectious mononucleosis, but also in the development of a number of oncological and chronic diseases. This determines its clinical significance.

Below is the association of the Epstein-Barr virus with various diseases (the list is incomplete).

- Infectious mononucleosis (glandular fever, Filatov's disease) is a common infectious disease, clinically characterized by elevated body temperature, enlargement of lymph nodes, inflammation of the pharyngeal mucosa, enlargement of the liver and spleen. In this case, the Epstein-Barr virus enters the body through the epithelium of the upper respiratory tract mucosa.
- Lymphogranulomatosis (Hodgkin's disease) and some types of non-Hodgkin's lymphomas belong to the group of diseases characterized by malignant monoclonal proliferation of lymphoid cells in the lymph nodes, bone marrow, spleen, liver, and gastrointestinal tract.
- Chronic fatigue syndrome is characterized by a feeling of fatigue that persists for a long time and does not disappear even after adequate rest.
- Chronic active EBV infection (CAEBV) is a relatively rare, more severe disease in which the virus persists in a constantly active state in the body. Clinically, not only fatigue, but also prolonged fever, enlargement of lymph nodes, enlargement of the liver and spleen, and changes in hematological parameters are observed.

- "Alice in Wonderland" syndrome (Alice in Wonderland syndrome) manifests as a disruption of a person's perception of their body or its individual parts. Such a patient feels that some parts of their body are too large or too small compared to their true size.
- Hepatitis associated with VEB is often observed as one of the complications of infectious mononucleosis. Clinically, weakness, nausea, jaundice of the skin and mucous membranes, and enlarged liver are observed.
- Herpetic infection can manifest as genital or labial damage. In addition, cases of EBV-associated stomatitis are observed. When the infection is activated, the patient experiences burning and pain, followed by the formation of numerous small blisters.
- Post-transplantation lymphoproliferative disease is a secondary malignant disease that develops after hematopoietic stem cell transplantation and is observed in association with EBV in patients with weakened immune system.
- Hair-like leukloplakia appears on the sides of the tongue mucosa in the form of white foci with an uneven surface. They are usually painless and do not cause significant discomfort, but there is a possibility that the altered cells will acquire malignant (malignant) characteristics.

Diagnostics

Diagnosis of VEB, regardless of the form of the disease, should be carried out on the basis of an epidemiological history, clinical manifestations, and the results of laboratory studies.

Laboratory tests and their use (incomplete)

1. EBV DNA in blood (whole blood / blood serum)

Used to confirm VEB contamination. Effective in detecting infection in newborns without antibodies. Screening studies can be used in patients with weakened immunity.

2. Exudate

It is used in clinical signs of infectious mononucleosis, as well as to determine the etiology of complications. It is also used in cases of screening and decreased immunity.

3. Urine

In the presence of infectious mononucleosis, it is used in combination with antibodies to determine the etiology of the disease. Screening is also effective in patients with weakened immunity.

4. Epithelial cells of the nasal mucosa

Used to determine the etiology of the disease and assess the activity of the infectious process. It is also used for screening and in patients with weakened immunity.

5. Cerebrospinal fluid (liquid)

It is used to determine the etiology of neurological complications, including those associated with infectious mononucleosis. It is also possible in cases of screening and decreased immunity.

6. Prostate secretion and ejaculate

It is used in the presence of reproductive problems and during comprehensive prenatal examination of spouses. Screening is also possible in patients with weakened immunity.

Each test can be used within the framework of preventive screening studies and in patients with weakened immunity.

Epidemiological history

The epidemiological history includes: the source of infection, transmission routes, the patient's immune status, and contact with infected individuals.

Main pathways: airborne droplets and contact, especially through saliva. Due to the widespread prevalence of EBV (more than 95% of patients are virus carriers), it is important to determine when and where the patient was infected.

Significance of the epidemiological history

1. Determining the probability of infection. It helps to understand how the infection occurred, which is important for further diagnosis and treatment.

2. Prevention of spread. By identifying the source of infection, it is possible to reduce the spread of the virus to other people.

3. Risk assessment in contacts. Anamnestic data helps to assess the risk of infection for the patient's family members and other close relatives.

Treatment

To date, no specific treatment or vaccine has been developed against the Epstein-Barr virus. Because the disease is caused by a virus, antibiotics are useless.

Treatment is aimed at eliminating general symptoms and includes adequate rest, compensation for fluid deficiency, and the use of painkillers and antipyretics. Avoid contact sports and weightlifting

In severe infections, antiviral drugs (antiherpes preparations) can be used, which help slow down the multiplication of the virus and reduce complications.

Prevention

Currently, there is no specific vaccine against Epstein-Barr virus (EBV) infection. The main problem in vaccine development is the diversity of protein structures at different stages of the virus's life cycle.

Therefore, to prevent EBV infection, it is recommended to:

- Observing personal hygiene rules - for example, frequently washing hands, using personal belongings.
- Strengthening general immunity - moderate physical activity, proper nutrition, and giving up harmful habits.
- Timely treatment of chronic diseases is the reduction of conditions that weaken the body.

Conclusion

The Epstein-Barr virus (EBV) is one of the most widespread viruses among humanity, and in most cases, it remains in a latent (sleeping) state, which the patient may live without even noticing. The virus is relatively easy to transmit, but an effective vaccine or complete treatment method has not yet been developed. Therefore, EBV infection is mainly directly related to the state of the body's immune system. In cases of weakened immunity, the virus can become active and cause various clinical symptoms. EBV not only causes acute or chronic infections, but in some cases also participates as an important factor in the development of severe oncological diseases. At the same time, it was the first oncogenic virus detected in humans and made a great contribution to the formation of modern oncovirology. This discovery allowed for a deeper understanding of the role of viruses in cancer. EBV is also of great diagnostic and scientific importance: it is used as a biomarker in clinical studies, an important model for studying the immune system's response to viruses. The high prevalence of the virus (infected by more than 90% of the world's population) makes it a global health problem. Currently, treatment is mainly symptomatic, and there is no possibility of completely eliminating the virus itself. Therefore, deeper scientific research on EBV, the creation of an effective vaccine and special antiviral drugs remains a pressing issue.

Note: The information presented in this article is intended to provide general scientific information. They cannot be used for self-diagnosis or treatment. In case of any symptoms, it is necessary to refrain from self-medication and consult a doctor.

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