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Diagnostics of the Origin of Encephalitis and Modern Clinical Diagnostics

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Abstract: Encephalitis is a life-threatening inflammation of the brain that can be caused by viruses or bacteria or as a serious complication of other diseases. Encephalitis is often caused by infections that are transmitted to humans from others or through the bites of ticks, mosquitoes, and other blood-sucking animals.

Keywords: What is encephalitis, Causes and development of the disease, Spread of encephalitis, What types of encephalitis are there: classification, Primary encephalitis: types and characteristics, Secondary encephalitis: types and characteristics.

What is encephalitis?

Encephalitis is an inflammation of the brain tissue. The Latin word encephalon means "brain" and the suffix -itis means "inflammation." Encephalitis is usually caused by an infection (usually viral or bacterial), the immune system's response to invading microorganisms, or other illnesses.

Inflammation leads to swelling of the brain, which is accompanied by a whole range of symptoms: headaches, impaired consciousness, convulsions, paralysis, and changes in the patient's behavior.

People of any age can get sick, but the most severe consequences occur in children and the elderly. The disease progresses rapidly and requires immediate treatment: this is the only way to reduce the risk of complications and death.

If the inflammation affects the brain and spinal cord at the same time, it is encephalomyelitis. If the meninges are involved, it is meningoencephalitis.

In the International Classification of Diseases, 10th Edition (ICD-10), encephalitis is coded G04.

Causes and development of the disease

The most common cause of encephalitis is a viral infection. Herpes viruses types 1 and 2, chickenpox, enteroviruses, and various arboviruses, which enter the human body through the bites of ticks, mosquitoes, flies, and other insects, can provoke inflammation of nerve cells.

In 30-62% of cases, the exact cause of encephalitis cannot be determined even with a complete examination.

Once inside the body, viruses enter the brain through the blood (hematogenous route) or along nerve fibers (neuronal spread).

The virus multiplies in nerve cells and damages them. Due to the activity of the pathogen, inflammation develops, which leads to dysfunction of brain neurons - various symptoms of encephalitis appear. The pathogen that causes this disease mainly determines which brain structures are affected.

The immune system is involved in fighting pathogens, but in some cases it itself can cause additional brain damage.

Spread of encephalitis

Among all encephalitis, the share of viral encephalitis is 80-89%.

Some viral encephalitis, such as tick-borne encephalitis and Japanese encephalitis, are common in certain areas and may be seasonal. Others, such as herpes encephalitis, can occur at any time of the year and are not regionally specific.

In Russia, tick-borne encephalitis is widespread in Siberia, the Far East, and the Urals. In Russia and European countries, tick-borne encephalitis is being recorded outside the norm.

What types of encephalitis are there: classification

If the brain inflammation is directly caused by a pathogen (virus or bacteria), it is primary encephalitis.

Secondary encephalitis develops as a complication of other infectious and inflammatory processes, for example, otitis media.

When classifying primary and secondary encephalitis, the cause and time of onset of the disease, its nature and severity, as well as the type and area of brain damage are taken into account.

Encephalitis by rate of development:

hyperacute - develops very quickly, sometimes within a few hours. The disease usually ends badly - the death or disability of the patient;

acute - begins abruptly and develops rapidly, symptoms are pronounced;

subacute - begins more slowly than acute and may have less severe symptoms;

chronic - the disease lasts for a long time after or without an acute period, and the patient's condition gradually worsens with periods of exacerbation and remission of symptoms;

Recurrent - a variant of chronic encephalitis, when symptoms of the disease reappear after an apparent recovery.

The rate of development of encephalitis depends on the characteristics of the pathogen that has entered the body, as well as the reaction of the human immune system.

By distribution:

leukoencephalitis - affects mainly the white matter of the brain, which makes up a large part of its volume;

polioencephalitis - the inflammatory process involves the gray matter located in the brain stem;

Panencephalitis - inflammation affects all areas of the brain.

By localization:

cortical - inflammation and damage to various areas of the cerebral cortex;

subcortical - inflammation of brain structures associated with processing emotions and behavior;

root - the brainstem (the structure that connects the brain and spinal cord) is affected;

cerebellar - inflammation of the cerebellum (an area of the brain that plays an important role in coordinating movements and maintaining balance).

The location of encephalitis can affect the severity of the disease, as well as the choice of diagnostic and treatment methods.

Encephalitis can be classified as moderate, severe, or severe in severity. The severity depends on the cause of the disease, the location of the pathological process (i.e., which brain structures are inflamed), and the patient's age and general health.

Primary encephalitis: types and characteristics

Primary encephalitis is an independent disease caused by infectious agents (viruses or microbes) that enter the central nervous system and damage neurons in the brain.

The most common causes of primary encephalitis are:

arboviruses,

many seasonal viruses,

unknown virus.

In addition to viruses, the cause of primary encephalitis can be bacteria: meningococci, pneumococci, including intracellular parasites - the causative agents of syphilis, typhus, and borreliosis.

Arboviruses: encephalitis after a bite

Arboviruses are a group of viruses with a diverse structure and properties. All of them are transmitted to humans by blood-sucking arthropods - ticks, mosquitoes, flies, mosquitoes. From English, ar-thropod virus is translated as "arthropod virus".

Arbovirus encephalitis is characterized by seasonality, endemicity, and epidemicity—that is, it is widespread, time-of-year, and regional. Cases typically peak from early spring to late fall, when mosquitoes and other vectors are active.

In Russia, Japanese encephalitis, which is spread by mosquito bites, is found in the Far East and Siberia, and encephalitis caused by the West Nile virus is mainly found in the southern regions. Tick-borne encephalitis is found in various regions, especially in forested and coastal areas with rich vegetation.

Herpes and other multi-seasonal viruses

Many seasonal viruses can cause illness at any time of the year. This group includes herpes viruses, influenza viruses, cytomegaloviruses, and enteroviruses. Sometimes rhinoviruses, coronaviruses, and adenoviruses, as well as rabies viruses, can cause inflammation of the brain.

Herpes encephalitis accounts for about 20% of all seasonal viral encephalitis. There are several types of herpes virus, but the most common type of encephalitis that causes cold sores is herpes simplex virus type 1 (HSV-1).

A unique feature of herpes infection is that after the initial infection, the virus remains in the human body for life. For most people, it may not manifest itself for a long time - it is in a latent, "dormant" state.

The pathogen "wakes up" during severe stress, illness, or taking certain medications. From the primary focus (the mucous membrane of the mouth and lips), the virus can penetrate the brain tissue through nerve fibers, causing encephalitis.

Lethargic sleep of unknown nature

A virus of unknown nature causes one of the most mysterious and mystical diseases - Economo lethargic encephalitis. Translated from Greek, lete - "forgetfulness", argia - "inaction".

After the stage of psychomotor agitation (headache, anxiety, hallucinations, or other neurological symptoms) typical of most types of encephalitis, an infected person is followed by a stage of immobility and silence.

Lethargic sleep develops gradually - deep, often turning into a coma, from which the patient cannot be awakened by sound, light, mechanical movements or drugs. Even if the patient wakes up for a short time, he immediately returns to such a pathological sleep state in any environment and under any circumstances.

Lethargic sleep can last for days or months. The literature describes years of such painful sleep, during which all attempts to wake the person have failed, and respiratory and cardiac problems have developed, leading to death.

The disease is rare, although an outbreak of encephalitis lethargica affected a number of European countries in the early 20th century. Little is known about the pathogen: it is believed to be an RNA virus. Experts have not yet been able to isolate and study it.

Tick-borne encephalitis

In the Russian Federation, tick-borne encephalitis is the most common disease of all neuroinfections transmitted through the bites of blood-sucking arachnids or insects. It is characterized by a variety of symptoms and a high frequency of negative consequences for the patient's health and life - disability and death. In ICD-10, it is designated by the code A84.

The causative agent of tick-borne encephalitis is a small RNA-containing flavivirus that is transmitted to humans through the bite of Ixodid ticks.

You can also get infected by consuming raw milk from infected goats, sheep or cows and dairy products that have not undergone sufficient heat treatment. When milk is pasteurized, the virus dies within 20 minutes, when milk is boiled, it dies within 2 minutes. The pathogen tolerates low temperatures and drying well: at a temperature of minus 60 degrees, it can live for decades.

The virus is able to survive in the body of ticks for a long time, "waiting out" the season of activity of blood-sucking parasites - from early spring to the end of September. Therefore, another name for tick-borne encephalitis is spring-summer.

On average, 1-3% of ixodid ticks are infected with tick-borne encephalitis virus.

If a tick is infected with the encephalitis virus, it can infect a person up to 80% of the time when it bites.

Ticks can attach to any part of the human body, but usually choose areas with thin and delicate skin: armpits, neck, chest, scalp, behind the ears, groin area, popliteal fossa. After a walk in nature, you should always check yourself, your loved ones and animals for ticks.

When a tick bites, the bacteria that cause borreliosis, as well as the bacteria and protozoa that cause anaplasmosis, ehrlichiosis, and babesiosis, enter the bloodstream.

Ticks remain on the skin until they are saturated with the victim's blood - they can feed for anywhere from a few hours to a few days.

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Ticks lack all senses except temperature and vibration. Since they cannot jump or fly, they climb plants from 25 centimeters to 1 meter high, waiting for the temperature to rise, the vibrations of

the soil and air to indicate the approach of a potential feeder (this type of parasitism is called grazing-waiting).

When an animal or person passes by, the tick attaches itself, finds a suitable spot on the body, and then uses its mouthparts to pierce the skin and begin feeding on blood.

A tick bite is painless, so it is not immediately noticeable. When the bloodsucker is saturated, it increases significantly in size. It may take several days before the tick releases its victim.

What to do if bitten by a tick

If you find a tick on your body, it is best to go to the nearest emergency room for medical attention. If this is not possible, you should remove the parasite yourself as soon as possible. The longer the tick remains on the skin, the higher the risk of transmitting the infection to a person.

Procedure for removing a tick:

Using tweezers or fingers wrapped in several layers of gauze, hold the bloodsucker as close to the skin as possible.

Using light twisting movements, remove the parasite.

Treat the skin area with an antiseptic.

Store the removed tick in a sealed container for testing in a laboratory for infection.

Extraction

It is important to grasp the attached tick correctly to avoid damaging it and pulling it out completely.

Attempts to remove the tick using oil, corrosive liquids, or cauterization can cause the parasite to release its intestinal contents into the wound, increasing the risk of infection.

Symptoms of tick-borne encephalitis

The symptoms of tick-borne encephalitis depend on how much virus has entered the body, as well as the person's age and health, the severity of the immune response, and previous vaccinations. The disease is somewhat more severe in children and the elderly.

Early therapy (passive immunoprophylaxis) helps stop the progression of the disease and leads to a full recovery.

It usually takes 7-14 days from the time of infection (the site of the bite) to the first symptoms. The incubation period can be shortened to 5 or extended to 25 days.

Symptoms of tick-borne encephalitis:

high body temperature (up to 39-40 degrees);

headache, which can be very severe and accompanied by vomiting;

muscle and joint pain, weakness and fatigue;

coordination of movements is impaired: staggering when walking, uncertainty in movements, falls;

decreased brain activity: lethargy, apathy, loss of memory and attention;

visual and hearing impairment: some patients experience double vision, decreased visual acuity, tinnitus, or hearing loss;

twitching in certain muscle groups, in severe cases - convulsions and impaired consciousness;

partial (paresis) or complete (paralysis) loss of control over the muscles of the face, arms, and legs.

Headache may be one of the first symptoms to appear in a patient with tick-borne encephalitis.

After the initial symptomatic phase, the disease can become chronic. In this case, central nervous system (CNS) disorders develop gradually and can lead to serious changes in brain function.

Motor changes often develop, as well as social adaptation, which can lead to mental disorders. The patient may lose the ability to care for himself and require constant care.

In some infected people, infection can occur without clinical signs of the disease - the virus can only be detected through laboratory testing.

Secondary encephalitis: types and characteristics

Secondary encephalitis develops not as an independent disease, but as a symptom or complication of another pathology, such as measles, borreliosis, rheumatoid arthritis, and some cancers.

Secondary inflammation of the brain can be caused by allergies, an autoimmune reaction (the body's defenses mistakenly attack its own tissues, including the brain), or exposure to toxins - drugs, poisons, mercury vapor, heavy metals.

Secondary encephalitis can also be post-exanthemal (literally "after the rash"), post-vaccinal (after vaccination), bacterial, and parasitic.

Postexanthemal encephalitis

Secondary post-exanthematous encephalitis develops in some patients after viral infections that cause a rash (exanthema). For example, it can occur after having measles, rubella, or chickenpox.

The pathogens that cause these infections are able to remain in the body for a long time, hiding in nervous tissue after the main symptoms of the disease have disappeared.

For example, 6-8 years after recovering from measles, a person may develop subacute panencephalitis, which can lead to behavioral disorders, decreased mental abilities, and death.

Measles can cause post-exanthemal encephalitis

Whether a person develops post-exanthematous encephalitis depends on many factors, including weakened immunity, chronic diseases, and heredity. For example, the patient's age is important: children and the elderly, due to the characteristics of the immune system, are at greater risk of secondary inflammation of the brain.

Post-vaccination encephalitis

Postvaccinal (post-vaccination) secondary encephalitis is a very rare complication after vaccination against chickenpox, pertussis, diphtheria, tetanus, and rabies.

It can also occur if a person has an individual sensitivity of nervous tissue to the components of the drug, as well as when an atypical autoimmune reaction occurs.

It is often difficult to establish a cause-and-effect relationship: the pathological process develops directly due to vaccination or is not in any way related to vaccination, but coincides with it in time.

Bacterial and parasitic encephalitis

Bacterial and parasitic encephalitis can occur with staphylococcal and streptococcal infections, tuberculosis, toxoplasmosis, malaria, and chlamydia.

This type of encephalitis progresses rapidly. It is important to identify the underlying disease and begin treatment as soon as possible to prevent serious complications and death of the patient.

Symptoms of brain inflammation

Symptoms of brain inflammation depend on the type and aggressiveness of the pathogen, the severity and form of the disease, the patient's age and general health.

Common symptoms of encephalitis:

a. headaches of varying intensity - may begin gradually or appear suddenly;

b. nausea and vomiting - often associated with increased intracranial pressure and correlated with the intensity of the headache;

c. fever - often the body temperature rises to 39-40 ° C;

d. convulsions - single or repeated;

e. a feeling of extreme fatigue, muscle weakness or complete immobility of a certain part of the body - due to a disorder of the nervous system;

f. impaired consciousness up to coma - in severe and extremely severe encephalitis;

g. impaired vision, hearing, speech - due to the involvement of certain areas of the brain in the pathological process;

h. behavioral changes - anxiety, disorientation, aggression, hallucinations.

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