

THE MINISTRY OF HEALTH OF UKRAINE  
ZAPORIZHZHIA STATE MEDICAL UNIVERSITY

Department of infectious diseases

**MENINGEAL SYNDROME IN THE CLINIC OF  
INFECTIOUS DISEASES.  
SWELLING OF BRAIN (emergency care)**

**Manual for 6th year students of II international faculty**  
*2nd edition, supplemented and revised*

Zaporizhzhia  
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M55

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*and it is recommended for the use in educational process for foreign students.*

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The urgency of the problem of meningitis and meningoencephalitis of bacterial and viral etiology is due to the significant frequency of severe forms, high mortality, difficulties in laboratory decoding of the diagnosis, and in a number of serous meningitis also the lack of specific treatment. According to the European Federation of the Neurological Society, meningitis is recorded with a frequency of 2-5 per 100 thousand people in Europe and ten times more often in less developed countries. Despite modern advances in the treatment of neuroinfections using modern etiological and pathogenetic therapy, mortality from them over the past 20 years has not changed significantly. In the world, neuroinfection continues to be one of the most common forms of damage to the central nervous system. Meningitis is one of the top ten causes of death associated with infectious diseases, and takes second place among the causes of primary disability of the population, second only to vascular pathology of the brain. Despite modern treatment, 35-70% of convalescents of meningitis have chronic fatigue, depression, sleep disturbance, emotional, behavioral and motor disorders, cognitive dysfunction, convulsions, astheno-neurotic, cerebro-asthenic syndromes.

One of the most important syndromes in meningitis and meningoencephalitis is meningeal. In the clinic of infectious diseases, meningeal syndrome is observed in many infectious diseases caused by bacteria, viruses, fungi, protozoa. Meningeal syndrome includes: headache, vomiting, general skin hyperesthesia with increased sensitivity to sound and light stimuli, the presence of positive meningeal symptoms. Headache can be diffuse or localized (mainly in the forehead and neck), painful, pressing or bursting in nature. The occurrence of headache is associated with irritation of the sensitive endings of the trigeminal nerve, parasympathetic (vagus nerve) and sympathetic fibers innervating the membrane of the brain.

Vomiting occurs without connection with food intake, does not bring relief to the patient. It is of central origin and is associated with irritation of the vagus nerve receptors or its nuclei located on the bottom of the IV ventricle, or the vomiting center in the reticular formation.

Skin hyperesthesia and hypersensitivity to sound and light stimuli (hyperacusia, photophobia) are associated with irritation of the posterior roots.

Positive meningeal symptoms: neck stiffness, Kernig's sign, Brudzinski's sign, Hyena, Matus, Fanconi and others - a consequence of reflex tonic muscle contraction as a protection of nerve roots from excessive irritation.

**Neck stiffness** occurs as a result of increased tone of the extensor muscles of the neck. The patient lies on his back without a pillow, his hands are located along the body. The doctor is trying to flex the patient's head. The patient cannot bring the chin to the sternum (the patient does not reach the sternum with the chin). Any attempt is accompanied by a sharp pain. Opening of the mouth, lifting of the shoulder girdle, rotation of the head can lead to an incorrect assessment of neck stiffness.

The **Kernig's sign** is also a very early and characteristic symptom of damage to the meninges. The patient is lying on his back. The doctor flexes the patient's leg in the knee and hip joints at an angle of 90 degrees. The doctor cannot straighten the patient's leg in the knee joint to an angle of 180 degrees. Doctors sometimes make mistakes when checking for Kernig's sign. If you flex the patient's leg in the hip joint at an angle more than 90 degrees, then even with a sharply positive Kernig's sign, he will be assessed as negative (Fig. 1).

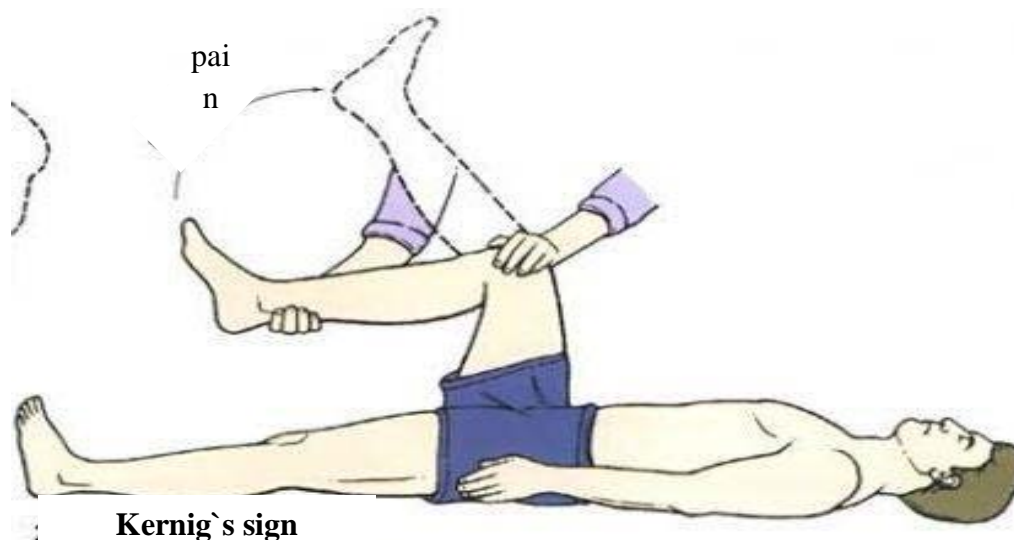


Fig. 1. Kernig`s sign

**Brudzinski's upper sign** is checked at the same time as neck stiffness. When the doctor tries to bring the patient's head to the sternum, the patient's legs involuntarily flex at the knee joints (Fig. 2).

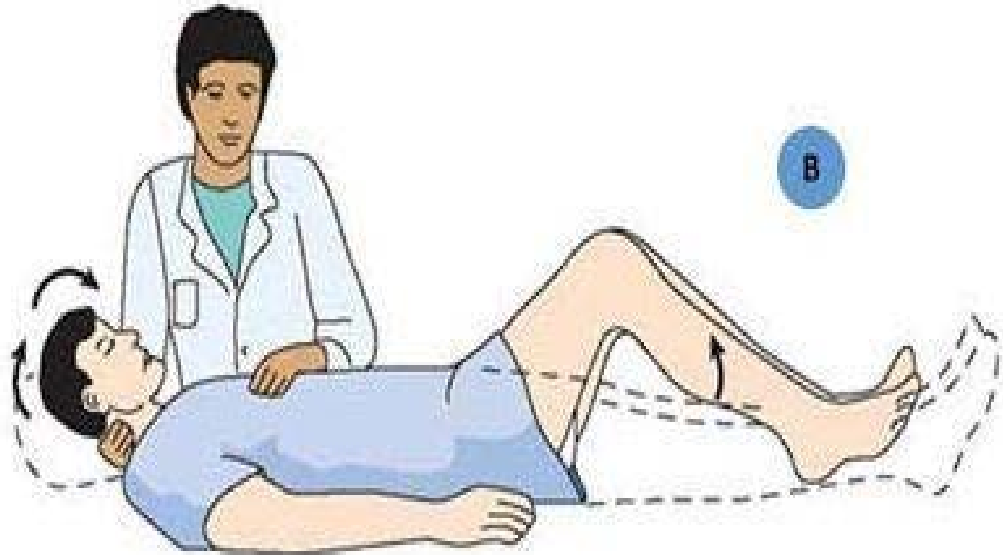


Fig. 2. Brudzinski's upper sign

**Brudzinski's zygomatic sign** - the same reaction with percussion of the zygomatic arch.

**Brudzinski's pubic sign** - the patient bends the legs in the knee joints with pressure on the pubic joint (Fig. 3).

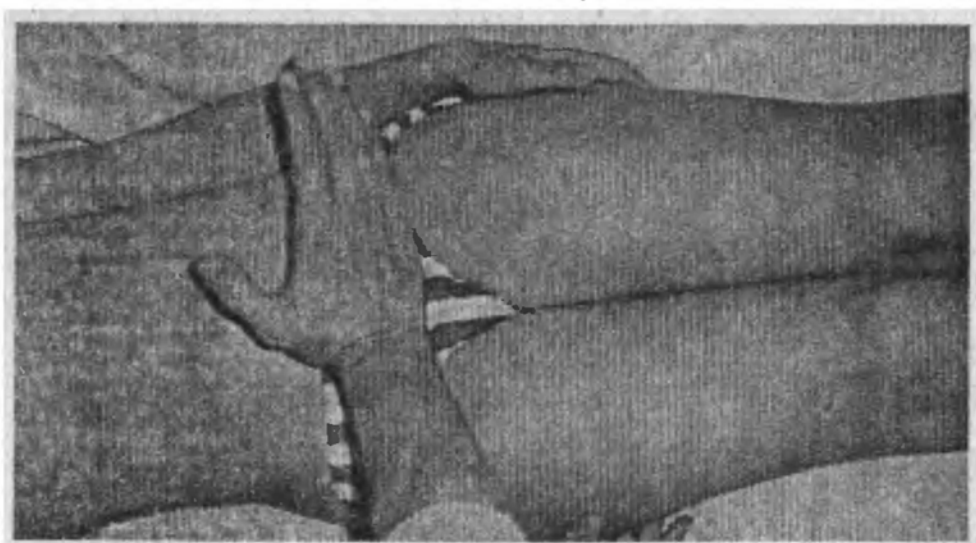


Fig. 3. Brudzinsky pubic symptom

**Brudzinski's lower sign** is investigated simultaneously with the Kernig's sign. When the doctor tries to straighten the patient's leg in the knee joint, the other leg flexes in the knee joint and leads to the body (Fig. 4).

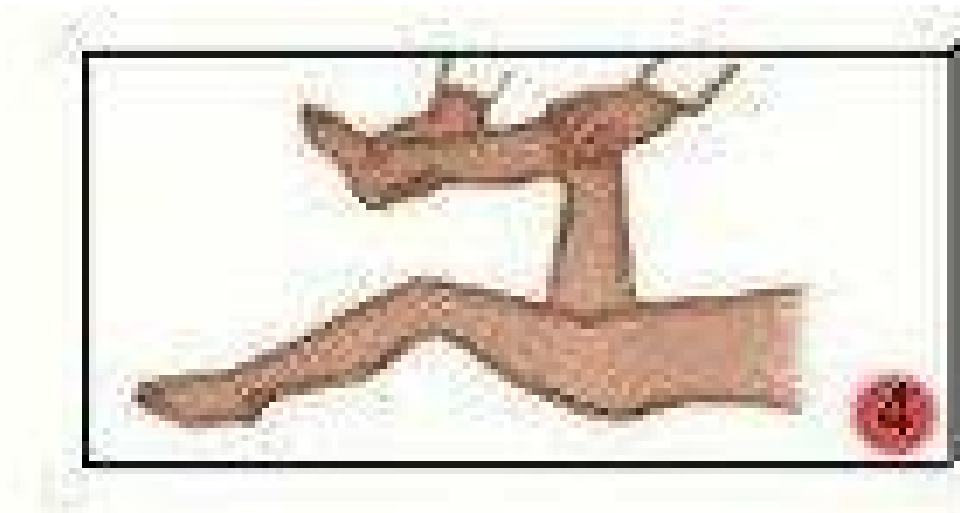


Fig. 4. Brudzinski's lower sign

**Hyena symptom** is similar to Brudzinsky's lower symptom. The doctor squeezes the quadriceps muscle of one leg, the other leg flexes at the knee and leads to the body.

Tension of the long muscles of the back is a common symptom of meningeal syndrome and is detected in the form of the following symptoms:

1. **Matus sign** The patient lies on his back. The doctor fixes the legs straightened at the knees with the right hand, with the left hand they support the patient's back and helping him to sit down. With meningeal syndrome the patient cannot sit directly with straight legs.

2. **Fanconi's sign.** The patient cannot sit with straight and fixed knees.

3. **Symptom of a "tripod".** The patient can only sit in bed with his hands behind his back.

4. **Symptom of the "knee kiss".** The patient cannot touch the knee with his lips when the lower limbs are flex in the hip joints.

5. **Bekhterev`zygomatic sign.** With percussion of the zygomatic arch, the patient experiences a headache and a painful grimace involuntarily occurs on the corresponding half of the face.

Meningial symptoms are non-specific signs that indicate only irritation or inflammation of the brain membranes. This can occur in many pathological conditions:

- craniocerebral trauma;
- brain tumors;
- subarachnoid hemorrhage;
- comatose conditions, which accompany the severe course of diabetes, kidney and hepatic insufficiency;
- carbon monoxide poisoning, thermal and solar impact.

When involved in the process of brain matter, general cerebral symptoms appear which are caused by inflammatory and toxic neurocytes damage. Encephalitic symptoms are manifold. It can manifest psychomotor excitation, a violation of consciousness, a defeat of cranial nerves (more often III, VI, VII pairs), convulsions, visual and auditory hallucinations. Often, focal cerebral symptoms are manifested in the form of pyramidal insufficiency: pronounced anisoreflexia of tendon and periosteal reflexes, spastic hemi- and paraparesis, coordination disorders, positive pathological reflexes.

**Babinski reflex** - in case of intense irritation of the outer part of the sole, a slow tonic extension of the big toe and fan-shaped dilution of the other toes (Fig. 5).

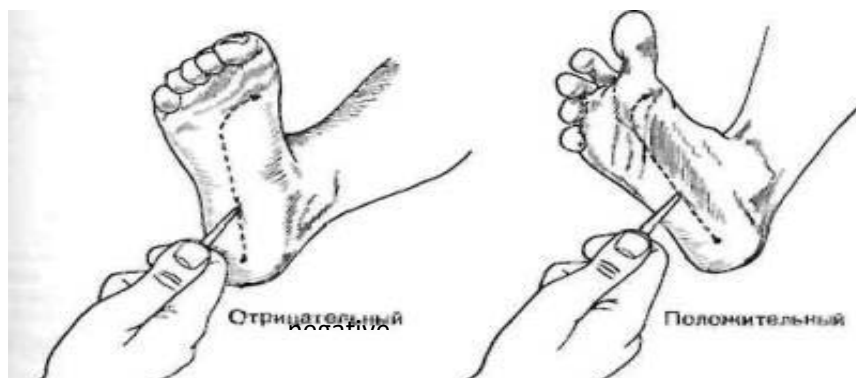


Fig. 5. Babinski reflex



**Oppenheim reflex** - when the palm is held on the front surface of the lower leg from top to bottom, you can see the flexion of big toe, sometimes with the simultaneous dilation of the other toes (Fig. 6).

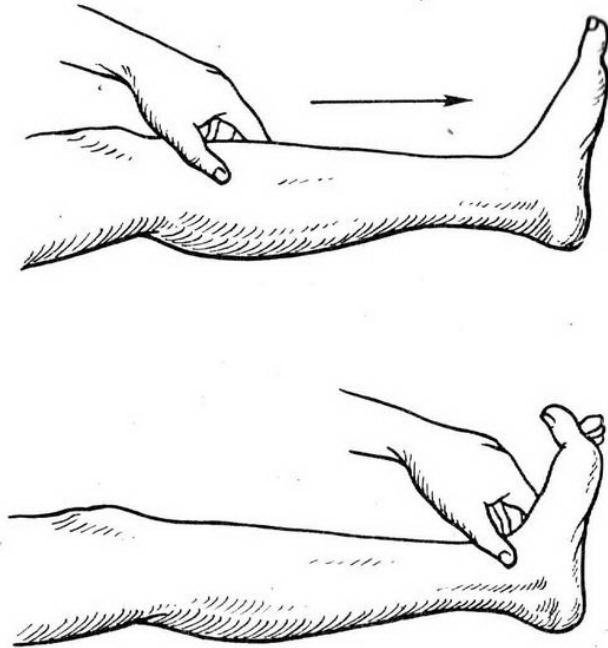


Fig. 6. Oppenheim reflex

Oppenheim food reflex – with a short touch to the lips, the tongue appears suckling, swallowing movements of oral automatism.

Rossolimo reflex - when resting on the ends of the II - IV toes, slightly flex in all joints, there is a short flex ("finger brush") of the foot (Fig.7).

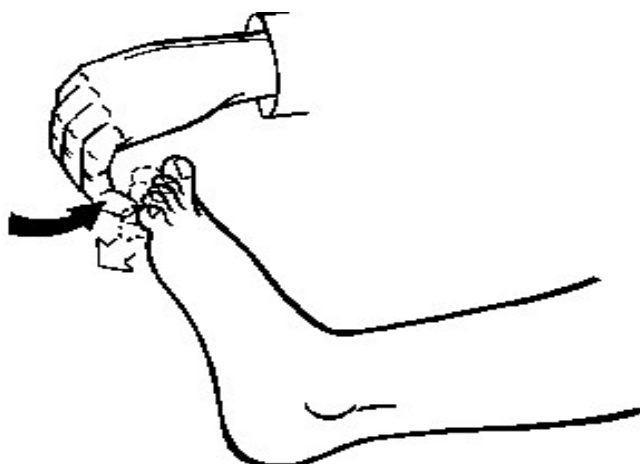


Fig. 7. Rossolimo reflex

Violation of movements in the form of a disorder of their coordination (ataxia) is identified during a series of tests.

**Heel-knee test.** The patient, who lies on his back with his eyes closed, is offered to raise his leg high and heel to get into the knee of the other leg - the patient misses.

**Finger-nasal test.** The patient pulls his hands forward. Then he is offered to slowly get his index finger into the tip of the nose, - he carries his hand past the target.

**Heel-cam test.** The patient lies on his back. Under the heel of the patient, the doctor puts his fist and invites the patient to lift his leg, and then lower it to the doctor's fist - while the ataxia is shown.

In addition to dynamic ataxia, the patient can also observe static ataxia: The patient is shaken from side to side, broadly pointing his legs, it is difficult to maintain balance.

Vegetative disorders in meningitis and meningoencephalitis can be manifested by dissociation between the pulse and temperature (slowing the pulse at raised temperature and accelerating it at normal temperature), arrhythmia, weak filling of the pulse, impaired rhythm and depth of breathing, signs of increased lability of the vasomotor apparatus: when pressure is applied to the skin, red and white spots, Trusso spots are characteristic (the patient then turns red, then turns pale).

In the presence of meningeal syndrome, the cerebrospinal fluid test is mandatory. When conducting lumbar puncture, a number of rules must be observed. Lumbar puncture is carried out with the consent of the patient or relatives. Before puncture, the patient should be examined by an ophthalmologist: When edema of the optic nerve disk from puncture, it should be temporarily abstain, first prescribing dehydration therapy. If the puncture is necessary of *vital importance*, the cerebrospinal fluid should be taken with a small volume of up to 3-5 ml to avoid wedging. Lumbar puncture is performed in the position of the side. In order to determine the location of the puncture with an iodine-soaked cotton rod,

a line is drawn connecting the crests of the ilium bones. This line cuts the spine at level III or between III and IV lumbar vertebrae. Usually a puncture is made between III and IV or IV and V lumbar vertebrae. The roots of the ponytail floating in the liquid thanks to its elasticity «go away» from the needle, and it does not hurt them. After processing the skin with iodine, then with ethyl alcohol, the needle is taken for lumbar puncture (mandren needle) and is injected directly under the lumbar vertebrae IV (V). The needle is inserted in such a way that it is in a strictly saggital plane. The end of it should look up, and the body slide down the spine of the vertebrae IV. At the moment of the passage of the solid cerebral envelope, there is usually resistance and then failure, indicating the penetration of the needle into sub-arachnoid space. The extraction of the mandren is accompanied by the exhaustion of the fluid. Once the fluid is extracted, the needle is quickly removed. The puncture is iodized and glued with a sterile napkin. After an LP, the patient must lie on his abdomen for at least two hours without pillows and it is advisable to stay in bed for 24 hours. During an LP, the patient may feel a pain in his leg caused by an injection of the ponytail. This pain will soon fade.

Sometimes the needle cuts the veins of the casings or venous plexus, so that the leaking liquid contains a blood impurity. It is necessary to remember that when there is a «track» blood, the fluid is not evenly stained, and after centrifuging, the pre-plant liquid remains colourless. There's no danger of this bleeding (Рис. 7).



Figure 7. Performing lumbar puncture

By the nature of the changes in the cerebral spinal fluid, it is possible to speak of meningism, meningitis or sub-arachnoid haemorrhage, in which a cerebral spinal fluid with a uniform impurity of blood is produced and the external fluid has a xanthosomic color.

Meningism is the clinical manifestation of irritation with toxins of the brain membranes with dysfunction without inflammatory changes of cerebrospinal fluid. Meningism can be observed in many infectious diseases of both bacterial (shigellosis, salmonella, typhoid, etc.) and viral (influenza, measles, infectious mononucleosis, etc.) nature. Cerebral spinal fluid in meningism as a result of cerebral hypertension flows under increased pressure but has a normal composition (pleocytosis less 10 cells in 1  $\mu$ m due to lymphocytes, protein content - 0.33 g/l, sugar - 2.50-3.30  $\mu$ m/l (1/2 in venous blood).

Treatment for meningism consists in prescribing specific treatment for this infectious disease and reducing intracranial pressure. In meningism, the puncture itself has a positive effect.

In meningitis, besides cerebral hypertension due to the hyperproduction of spinal fluid, lesions of the membranes of the brain develop with the development of inflammatory process in them. Modern views of the pathogenesis of meningoencephalitis indicate the involvement of a large number of pathogenetic mechanisms in their development. Most of these mechanisms are associated with a violation of neurotrophic processes, a stressful effect on the body of infectious agents, hypoxic-ischemic damage to the nervous tissue, which both directly and indirectly lead to damage to neurons, as a result of which there are development of complications and irreversible changes in the central nervous system. Meningitis is primary and secondary. Primary meningitis develops without a previous common infection or disease of any organ. Secondary meningitis is a complication, it has a primary focus of inflammation (boil, intestinal infection, gall bladder infection, inflammation of the sinuses, middle ear, eyeball, etc.). In this case, we are talking about the development of secondary metastatic purulent meningitis. Purulent

meningitis can also develop with open craniocerebral trauma, with fractures and cracks in the base of the skull, accompanied by cerebrospinal fluid.

By the nature of changes in the cerebrospinal fluid, meningitis is divided into serous and purulent. With serous meningitis, pleocytosis in the cerebrospinal fluid is lymphocytic, with purulent neutrophilic. Serous meningitis is divided into viral and bacterial. To viral serous meningitis include: herpetic, enteroviral, measles and others. To bacterial serous meningitis include: tuberculosis, leptospirosis and others.

Meningitis, except bacteria and viruses, can be caused by fungi (candida) and protozoa (toxoplasmosis).

Depending on the duration of the course, meningitis is divided into acute (symptoms last for several days) and chronic (lasts from a month to several years).

### **Principles for the diagnosis of meningitis and meningoencephalitis.**

Diagnosing the disease is sometimes quite difficult. When making a diagnosis, take into account:

- clinical picture and objective examination data;
- data on the epidemiological history (for example, with mumps there is contact 1.5 to 3 weeks before the disease with mumps);
- an anamnesis of life (for example, with pneumococcal meningitis, the patient has an exacerbation of chronic purulent otitis media, in which, against an increase in temperature, pain in the ear appears, otorrhea intensifies and meningeal signs are detected);
- cerebral fluid test results:
  - 1) the presence of pleocytosis and its nature (general clinical laboratory);
  - 2) sugar content, protein (biochemical laboratory);
  - 3) isolation of meningococcus, pneumococcus and other bacteria during bacteriological examination;
  - 4) isolation of herpes simplex viruses, etc. by PCR or in a virological laboratory during infection of chicken embryos, tissue culture, etc;

- serological research methods (for example, to confirm borreliosis meningitis, the detection of anti-borreliosis antibodies in cerebrospinal fluid and blood with the calculation of cerebrospinal fluid index);

- non-specific laboratory research methods (for example, high leukocytosis with neutrophilia in a general blood test indicates, as a rule, bacterial damage and the need for antibiotic therapy);

- instrumental research methods: electroencephalogram (allows you to clarify the presence of structural changes in the brain by its bioelectric activity); computed tomography, which allows to detect with encephalitis a decrease in the density of brain tissue (foci of low density without clear boundaries), with tumors foci of uneven density; with an abscess of the brain - the formation of a round shape with a zone of low density inside, but with a high density of the contours of the capsule; nuclear magnetic resonance imaging.

### **Principles of treatment of meningitis and meningoencephalitis.**

In the practice of treating meningitis, various etiotropic drugs are used. For meningitis caused by bacteria and fungi, antibiotics are used. Depending on the type of exposure to the microbial cell, antibiotics are classified into two groups:

- bactericidal (penicillins, cefasporins, aminoglycosides, rifampicin, etc.);
- bacteriostatic (chloramphenicol, macrolides, lincomycin, etc.).

According to the spectrum of antimicrobial action, antibiotics are divided into the following groups:

1. Broad-spectrum antibiotics: ampicillin, carbepicillins, cephalosporins, aminoglycosides, chloramphenicol, tetracycline, macrolides, carbapenems.
2. Drugs acting on gram-positive bacteria and cocci: oxacillin, vancomycin, fusidine, etc.
3. Antibiotics active against gram-negative bacteria: polymyxins.
4. Tuberculosis antibiotics: streptomycin, rifampicin, florimycin.
5. Antifungal antibiotics: nystatin, levorin, ketoconazole, diflucan and others.

When prescribing an antibiotic, it is necessary to take into account the possibility of it penetrating well through the blood-brain barrier and have minimal toxicity to the central nervous system. During treatment, the dose cannot be reduced, since the concentration of the antibiotic in the cerebral fluid depends on the permeability of the blood-brain barrier (with a decrease in inflammation, permeability decreases). A change in antibiotic is advisable only in the absence of a therapeutic effect within 72 hours or in case of the appearance of an undesirable reaction (for example, allergic). When changing an antibiotic, it is important to take into account the sensitivity of the pathogen that caused the disease to certain antibiotics.

The effectiveness of antimicrobial therapy in bacterial and fungal meningoencephalitis can be judged by a number of indicators in the cerebrospinal fluid, such as:

- a decrease in protein levels of 1.5-2 times;
- increase in glucose level;
- increasing the pH of cerebrospinal fluid over 7.1.

With meningitis caused by viruses, antiviral therapy is carried out, which, unlike antibacterial, has a significantly smaller arsenal of choice. Currently, the following drugs are available for the treatment of viral meningitis:

- antiherpetic (nucleoside analogues - acyclovir, valaciclovir, pencyclovir, phamcyclovir);
- anticytomegalovirus (gancyclovir, phospharnet, cidophavir);
- anti-influenza (Ozeltamivir, Zanamivir, Amanthadin, Remathaddin).

The disadvantage of antiherpetic drugs is the lack of effect on latent viruses.

Pathogenetic therapy.

The primary goal with an acute increase in intracranial pressure is urgent dehydration measures. For this purpose, use saluretics and osmodiuretics. Lasix at a dose of 40 mg is administered intravenously, not faster than in 1-2 minutes. The diuretic effect of Lasix occurs in 3-5 minutes, but the dehydration effect manifests itself at a later date. Of osmodiuretics, mannitol solutions (10%, 15%, 20%) are

used at the rate of 1 g / kg of body weight intravenously drip for 60 minutes. For example, patient weight 60 kg, mannitol solution 20% (100 ml of 20% mannitol solution contains 20 g., and you need to enter 60 g. - This corresponds to 300 ml of 20% mannitol solution). Mannitol is prescribed with caution, as it is characterized by the phenomenon of "bestowal." When prescribing mannitol, plasma osmolarity is taken into account (with plasma osmolarity above 320 mosm / l, the use of mannitol is contraindicated). Orally through a nasogastric tube or by drinking with water, the most safe osmotic diuretic is used - glycerin at 2 g / kg body weight. Diacarb (carbonic anhydrase inhibitor) 1 tablet 1-2 times a day.

Diuretics are prescribed in combination with infusion - detoxification therapy. Crystalline (physiological solution of sodium chloride, Ringer's solution, 5% glucose solution, glucose-potassium mixture, lactosol, etc.) and colloidal (reformed, gelofuzin, stabizol, albumin, etc.) are administered intravenously in the ratio 3 to 1 (3: 1). The number and speed of the introduction of solutions is determined by many factors: the patient's weight, how much the patient has a body temperature, the amount of urine released, blood pressure, etc. In patients with meningitis, the total number of infusion solutions with continuous drip is calculated as follows: 35 ml / kg (daily requirement in liquid) plus for every degree of temperature increase 3.5 ml / kg (loss by evaporation from the skin surface with perspiration). For example, the patient's weight is 60 kg, body temperature is 39°C. The additional amount of solutions is:  $3.5 \text{ ml} \times (39^\circ - 37^\circ) \times 60 = 420 \text{ ml}$ . When carrying out detoxification measures, it is necessary to proceed from the fact that the so-called general intoxication syndrome is caused by exposure to both microbial toxins and an excess of biologically active substances entering the bloodstream in response to microbial aggression, as well as the products of alteration of inflamed tissues, toxic metabolites due to hemodynamic disturbances.

In severe meningitis, glucocorticoids (prednisone, hydrocortisone, dexamethasone, etc.) in small doses (1-2 mg / kg according to prednisone) are indicated for 3 -5 days. Glucocorticoids have a membrane-stabilizing anti-inflammatory effect, block the release of histamine, serotonin, kininogens,



acetylcholine, which helps to reduce the permeability of tissue membranes, have a detoxifying effect. According to the anti-inflammatory effect, prednisone is 5 times stronger than hydrocortisone. Dexamethasone in turn 7 times stronger than prednisone and it practically does not affect the water-electrolyte balance.

With encephalitis, the dose of hormones and the duration of their administration increases depending on the severity of the course.

High danger in meningitis and encephalitis is brain hypoxia. All therapeutic measures must be carried out against the background of constant inhalation of well-moistened oxygen. Oxygen inhalation can be carried out using various oxygen - respiratory equipment: through the nasal cannula, nasal cavity mask, endotracheal tube. With a nasal fork-shaped cannula, the patient has the opportunity to speak, drink and eat during oxygen therapy. At the same time, the facial mask gives a higher oxygen concentration and provides humidification of the respiratory mixture.

In the period of early convalescence immediately, after the abolition of etiotropic drugs, are shown:

- drugs that improve microcirculation in the vessels of the brain. Pentoxifylline can be administered intravenously, intramuscularly, or orally. 100 mg are injected intravenously in 250 ml of physiological saline slowly, drip over 90 - 180 minutes. Intramuscularly administered by 100 mg 2 times a day deep into the muscle. 200 mg orally 2 times a day, swallow dragees without chewing, and drink plenty of water;

- drugs that normalize the processes of tissue metabolism of the brain. Piracetam, nootropil (the active substance is piracetam). Piracetam 2 capsules 3 times a day for 6 weeks. In some cases, you can use cerebrolysin 1 ml (40 mg) intramuscularly. Cerebrolysin is capable of metabolic regulation, neuroprotection, functional neuromodulation and neurotrophic activity;

- from 4 to 5 weeks of rehabilitation treatment, adaptogenic drugs are indicated. For example, Eleutherococcus 30 drops 2 times a day for 3 weeks.

- After discharge from the hospital, patients who have undergone meningoencephalitis should be registered with a neurologist.

SERIOUS MENINGITIS VIRAL ETHIOLOGY  
(HERPETIC, CHICKENPOX, ENTEROVIRAL, PAROTITIS AND  
OTHERS)

**Herpetic meningitis, encephalitis and meningoencephalitis**

Herpetic meningitis caused by the herpes simplex virus in the general incidence of people with serous meningitis is 0.5-3%. Herpetic encephalitis accounts for 10-20% of the total number of viral encephalitis and occurs with a frequency of 0.3 - 1.8 per 100,000 population. According to the ICD-10 classification, herpes simplex virus infections have the SBI code, among which herpetic meningitis is in the form of B00.3 +, encephalitis B00.4 +.

The herpes simplex virus belongs to type 1 and type 2 herpes viruses (HHV -1 - HSV -1, HHV -2 - HSV-2), DNA containing, capable of prolonged persistence, have a cytopathic effect on infected cells, manifested in rounding and formation multinucleated cells.

The development of acute herpetic meningitis is possible with primary infection with the herpes simplex virus (30%), or in connection with the reactivation of latent herpes infection (70%). Currently, herpes simplex viruses or its antigens are found in 80-90% of adults.

Herpetic meningitis can occur in the form of damage to the central nervous system only, or be one of the syndromes of generalized herpetic infection, combined with damage to the skin and internal organs (liver, kidneys, pancreas).

The disease develops acutely: body temperature rises, headache appears, moderate photophobia, vomiting. Meningeal symptoms are mild or moderate. The cerebrospinal fluid pressure is increased, pleocytosis is low, lymphocytic (for example, neutrophils 18%, lymphocytes 82%), protein and sugar are slightly increased or normal. Symptoms of the disease last 5-7 days. After suffering meningitis caused by the herpes simplex virus type 2, one in five has relapses (Molaret meningitis).

A characteristic feature of herpetic encephalitis are pronounced changes in the brain tissue: pericellular and perivascular edema, dystrophic and

necrobiological changes in the nervous tissue. The tropism of herpesvirus to nervous tissue determines the occurrence of foci of necrosis of brain tissue mainly in the fronto-temporo-temporal regions, which leads to the development of gross neurological symptoms and causes high mortality.

The incubation period of herpetic encephalitis, meningoencephalitis is from 2 to 26 days, usually 9-14 days. The disease in 70% of cases begins acutely: the temperature rises quickly to febrile numbers, there is a severe headache, vomiting, convulsions, depression of consciousness. In 30% of cases, a gradual development of the disease is noted when intoxication, meningeal syndrome and local symptoms increase over several days (motor excitement, disorientation in space and time, depression of consciousness with delirium, visual, olfactory and auditory hallucinations occur). On examination, weakly or moderately expressed meningeal signs (Kerning, lower Brudzinsky) and focal cerebral symptoms are revealed: paresis of the facial muscles, anisocoria, nystagmus, damage to the cranial nerves (usually 3,5,6,7 pairs), anisoreflexion of tendon reflexes, pathological reflexes of Babinsky, Rossolimo.

Typical herpetic eruptions on the skin and mucous membranes occur in 10% of adult patients.

Acute herpetic encephalitis is difficult, with a high mortality rate (up to 20%), and disability (up to 50%) of those who have been ill. Often a fatal outcome develops within 48-72 hours from the onset of the disease from transtentorial wedging of the temporal areas or disturbance of the stem centers of respiration and cardiovascular activity. In the vast majority of cases, herpes simplex virus type I cause herpes encephalitis. The clinical picture of subacute and chronic meningoencephalitis, encephalitis can be quite diverse. In some cases, chronic herpetic encephalitis proceeds as a sluggish infectious process, as a variant of a slow infection.

**Specific diagnosis.** The main method for confirming herpetic meningitis, meningoencephalitis is the detection of herpes simplex viruses DNA in the

cerebrospinal fluid in the polymerase chain reaction (PCR). The specificity of the method is 100%, the sensitivity is 95%.

In the primary lesion, serological methods (ELISA, RSK) can be used to confirm the diagnosis. The diagnosis is confirmed by detecting a fourfold increase in antibody titer. With latent current infection, serological methods are not very informative.

Etiotropic therapy is carried out by acyclovir (synonyms - zovirax, virolex). With meningoencephalitis, intravenous administration of acyclovir solution at a dose of 30 mg/kg per day is recommended (the daily dose is administered in 3 doses every 8 hours for 14 days). Subsequently, up to 21 days, acyclovir is administered orally for 5 days - 4 g. per day (800 mg x 5 times), then 800 mg 3 times a day. Pathogenetic therapy is prescribed simultaneously with etiotropic. Its basis is the fight against brain hypoxia, intoxication, hyperhydration by the introduction of diuretics. Interferon preparations are prescribed simultaneously (Roferon-A 3 000000 per day - 10 days).

The extract is determined by the timing of the clinical recovery of convalescents. Having been ill with meningitis, meningoencephalitis, encephalitis are subject to follow-up by a neurologist.

**Chickenpox meningitis, encephalitis** is detected in 7.5% of cases of chickenpox. Chickenpox encephalitis makes up 35% of the total structure of viral encephalitis.

According to the ICD-10 classification, infections caused by  $\alpha$ -herpesvirus type 3 (HHV-3 - VZV) have the code B01 (chicken pox) and B02 (herpes zoster). Chickenpox meningitis refers to the form B 01. O +, chickenpox encephalitis - B 01.1 +. Herpes zoster with meningitis B 02.1+, herpes zoster with encephalitis B 02.0+.

Damage to the central nervous system can occur in the early days of the disease at the height of the disease, but much more often chickenpox

meningoencephalitis develops during the formation of crusts and even later, and is not associated with the severity of the acute phase of chickenpox.

After a few days of normal temperature, the patient's condition deteriorates sharply. The temperature rises again, severe headache, vomiting. Patients are inhibited, drowsy, give answers to questions in monosyllables. Cerebellar disorders are characteristic: tremor, nystagmus, ataxia. The patient's speech becomes dysarthric, slow, the gait is shaky, the patient complains of dizziness, "the bed is wobbling," the coordination of movements (positive finger-nasal and knee-calcaneal tests) is disturbed. Rigidity of the occipital muscles is poorly expressed. Cerebral fluid flows under pressure, clear, lymphocytic pleocytosis, the amount of protein and sugar does not change much. In a general blood test - leukopenia, lymphomonocytosis, ESR remains normal. The course of the disease in most patients is favorable. After a few days, the ataxia decreases, but the unsteadiness of the gait can persist for several months. It should be noted that with chickenpox, encephalitis, which develops in the early days of the disease, is prognostically more favorable. Encephalitis, which occurred later, is more severe. Mortality according to the authors ranges from 10 to 20%.

The chickenpox virus after subsiding of the acute manifestations of the primary infection can persist for a long time in the body as a latent infection. Varicella zoster virus (VZV) is believed to accumulate in the posterior roots of the spinal cord and the spinal ganglia. Complication in the form of meningitis, encephalitis can develop when infection is activated (herpes zoster), when the process captures not only the skin, but also the central nervous system.

The meningoencephalitic form of herpes zoster is relatively rare, but is severe with a mortality rate of over 60%. This form begins with gangliodermal manifestations, often in the intercostal nerves. Further symptoms of meningoencephalitis appear (meningeal symptoms, hallucinations, ataxia, hemiplegia, coma may occur). The time from the appearance of skin rashes to the development of meningoencephalitis ranges from 2 days to 3 weeks.

The diagnosis is made on the basis of the clinical picture of the disease and the data of the epidemiological history (contact 1.5 to 3 weeks before the disease with sick chickenpox or patients with herpes zoster).

**Specific diagnosis.** Virological method (virus isolation from cerebrospinal fluid, rash elements) - cultivating the virus on fibroblasts of skin-muscle tissue or epithelial cells of a human embryo is laborious, time-consuming, requires special laboratories and is not used in the daily work of a doctor.

Specific diagnosis of chickenpox and herpes zoster is aimed at detecting antibodies. The study is carried out in ELISA, RSK, RNGA. Blood is taken from a vein twice: in the first days of the disease and after 5-7 days. The reaction is considered positive with an increase in antibody titer of at least 4 times.

Specific therapy for chickenpox meningoencephalitis is carried out with acyclovir at a dose of 30 mg/kg per day (the daily dose is administered in 3 doses every 8 hours for 14 days). Subsequently, up to 21 days, acyclovir is administered orally for 5 days - 4 g. per day (800 mg x 5 times), then 800 mg 3 times a day. Pathogenetic therapy is prescribed simultaneously with etiotropic. Its basis is the fight against brain hypoxia, intoxication, hyperhydration by the introduction of diuretics. Interferon preparations are prescribed simultaneously (rheoferon 3 ml per day - 10 days). For chickenpox, 5% potassium permanganate solution, antiviral ointments (herplex, florenal, etc.), 1% brilliant green alcohol solution that dry and disinfect vesicles are used locally for the treatment of rashes. In cases of herpes zoster, measures aimed to relieve pain, as the introduction of acyclovir does not reduce their intensity. Non-narcotic analgesics are used in combination with tranquilizers. In addition, novocaine electrophoresis, novocaine blockade are performed.

### **Mumps meningitis (meningoencephalitis), encephalitis**

Mumps meningitis among meningitis of viral etiology is most common and develops in 10-15% of patients with mumps.

According to the ICD-10 classification, mumps complicated by meningitis has code B 26.1, and mumps complicated by encephalitis B 26.2.

Mumps virus is tropic to glandular and nerve tissue. The primary replication of the virus occurs in the epithelium of the upper respiratory tract, from where the virus enters the bloodstream, and then the parotid gland is affected in most patients, in others it begins with the following phenomena:

- \* submaxillitis, in which edema in the submandibular region is detected, sometimes in the form of a compacted roller;

- \* sublingvita, in which edema is localized under the tongue, displacing it upward and even sometimes making it difficult to move, the tongue itself becomes swollen;

- \* pancreatitis;

- \* meningitis.

In most patients, symptoms of meningitis appear through 5-7 days after swelling of the salivary glands, but this period can be long. In about 20% of patients, meningitis, pancreatitis, and mumps develop simultaneously. In 10% of patients, meningitis occurs 3-5 days earlier than inflammation of the salivary glands or occurs without mumps.

Meningitis develops acutely: chills appear, the body temperature rises again to 39°C and higher, severe headache, vomiting, anxiety, meningeal symptoms (stiff neck, symptoms of Kerning, Brudzinsky, etc.). However, in some patients there is a dissociation between the presence and severity of meningeal syndrome and the nature of the cerebrospinal fluid. Sometimes changes in cerebral fluid are noted in patients with mumps without signs of meningitis. With spinal puncture, cerebrospinal fluid flows under pressure, transparent, pleocytosis usually within hundreds, but can reach 1000 cells in 1 µl, mainly lymphocytic (up to 90%), but in the first days of the disease neutrophils can make up 30%. The protein content is moderately increased. The sugar content is normal. Meningeal symptoms and fever disappear through 10-12 days, while the rehabilitation of the cerebrospinal fluid is slower. The recovery period is sometimes delayed for weeks (rehabilitation of



cerebrospinal fluid - up to 1.5 -2 months). In a general blood test, leukopenia with lymphocytosis and normal ESR are characteristic.

Mumps meningitis occurs both independently and in combination with encephalitis (meningoencephalitis). The development of encephalitis is possible without meningitis against the background of unchanged cerebrospinal fluid composition, but increased cerebrospinal fluid pressure. For early encephalitis that occurred at 1 week of the disease, neuronal lysis is characteristic without demyelination resulting from the direct damaging effect of viruses. Late encephalitis (2 weeks or later) is mainly due to autoimmune reactions and is accompanied by demyelination processes. Late encephalitis is more severe.

The clinic of encephalitis is determined by the localization and prevalence of the process. Patients have impaired consciousness, lethargy, drowsiness, disorientation in place and time, emotional instability, and sometimes inappropriate and even aggressive behavior.

Of the neurological disorders, nystagmus, convergence disturbance, tremor of the extremities, speech disorder, facial paresis, hemi- and paraparesis, asymmetry of the abdominal and tendon reflexes, and sometimes pathological reflexes are characteristic.

After mumps meningitis and encephalitis, asthenization is observed for a long time.

The diagnosis of mumps meningitis and encephalitis is based on:

- clinical picture of the disease. A thorough examination of the salivary glands and other glandular organs helps, in particular, the study of amylase in blood serum with the determination of its isoenzymes, blood sugar. With mumps infection, the pancreas is often involved in the process and increased urine amylase activity lasts up to a month;
- data of an epidemiological history (contact 1.5 to 3 weeks before the disease with mumps);
- data on an anamnesis of life (previously did not have mumps).

After the disease, a stable immunity is formed and repeated cases of the disease are not registered.

Great difficulties arise in the diagnosis of mumps meningitis, if the lesion of the salivary glands is not pronounced or absent. In this case, mumps meningitis should be differentiated, first of all, from tuberculous and enteroviral meningitis.

**Specific diagnosis.** The virological method (virus isolation from cerebrospinal fluid, blood, swabs from the nasopharynx, secretion of the parotid salivary gland) is not used in the daily work of the doctor, because laborious method, available only to special laboratories.

The diagnosis of mumps can be confirmed by serological methods (RA, RTGA, RSK, etc.). Paired sera are examined: the first is taken at the beginning of the disease, the second - after 2-4 weeks. A diagnostic is considered to be a titer increase of 4 times or higher. Unfortunately, these reactions are only suitable for retrospective diagnosis.

**Treatment.** There is no etiotropic therapy for mumps infection. Pathogenetic therapy for mumps meningitis is aimed at combating brain hypoxia, intoxication, hyperhydration. A course of corticosteroids is necessary for severe meningitis for 5-7 days (prednisone 1 mg/kg, followed by a dose reduction or other corticosteroids in equivalent doses). Sedatives are indicated.

With encephalitis, corticosteroids are prescribed as early as possible in a dose 5 mg/kg of weight according to prednisone, especially if they arose at 2 weeks of illness and later (the possibility of the action of the allergic component as a leader). During infusion therapy, glucose solutions should be administered with caution, given the possibility of transient glucosuria even in the absence of obvious clinical signs of pancreatic damage. Desensitizing drugs are indicated (suprastin, pipolfen, etc.). In order to reduce local inflammatory phenomena in the lesion of the parotid gland - a warming compress on the gland.

**Enteroviral meningitis** is caused by all groups of enteroviruses: Coxsackie A (types 2.4.7.9), Coxsackie B (types 1-5), ECHO (types 4.6.11.16.30). The

disease is recorded both in the form of sporadic cases and in the form of epidemic outbreaks. An outbreak can be caused simultaneously by several types of enteroviruses.

According to the ICD-10 classification, enteroviral meningitis is under the code A.87.0 +, enterovirus encephalitis is A.85.1 +. Clinically, meningitis caused by different types of Coxsackie enteroviruses and ECHO cannot be distinguished. The disease begins in most patients acutely with fever, severe headache and repeated vomiting that is not related to food intake. Meningeal symptoms appear at the end of the first or second day of the disease. With a thorough survey and examination (although not always), hyperemia of the mucous membrane of the posterior pharyngeal wall with vascular injection can be detected. In some patients, vesicles appear on the moderately hyperemic mucous membrane of the palatine arches, tonsils, palate, tongue, posterior pharyngeal wall. The number of vesicles varies from 1-2 to 15. In 10-25% of patients, a rose-papular rash appears on the skin of the face and trunk, sometimes disappearing after a few hours. In some patients, cervical lymph nodes, liver, spleen increase. 10-15% of patients experience paroxysmal pains in the abdomen and lower chest. All these manifestations indicate the polytropy of enteroviruses and are not associated with damage to the nervous system. However, a combination of meningitis with other forms of the disease helps a lot with the diagnosis.

Cerebrospinal fluid flows under high pressure, transparent, in the first 2 days of the disease, pleocytosis reaches hundreds (100-700 cells in 1  $\mu$ l), often mixed, sometimes even with a predominance of neutrophils. In the following days, pleocytosis acquires a lymphocytic character. The protein content is normal or slightly elevated. The sugar content is normal. For a general blood test, the white blood cell count is normal or slightly increased. In the early days of the disease, moderate neutrophilia is often observed, followed by lymphocytosis. ESR within normal limits or slightly increased.

A feature of enteroviral meningitis is the presence in some cases of dissociation between meningeal syndrome and changes in cerebral fluid. So, in 15-

30% of patients, the clinical manifestations of meningitis are very weakly expressed in the presence of pronounced inflammatory changes in cerebral fluid. At the same time, in other patients with a sufficiently pronounced meningeal syndrome, cerebrospinal fluid may be intact.

The course of enteroviral meningitis is benign, cerebral swelling with dislocation is not observed. Meningeal signs usually completely disappear by 3-4 weeks of illness. By this time, cerebrospinal fluid is normalized.

Enterovirus meningitis occurs both independently and in combination with encephalitis. In this case, the symptoms quickly increase. Patients are inhibited, focal symptoms appear due to local brain damage (ptosis, hemiparesis and others), there may be a violation of swallowing, breathing, convulsions. The disease is severe.

In some patients who have undergone meningoencephalitis, residual effects of intracranial hypertension are possible (headache attacks, periodic vomiting, increased tendon reflexes, etc.) and persistence of post-infection asthenic syndrome for 2-3 months. In 10-25% of cases, relapses are possible.

The diagnosis is based on the clinic, data of an epidemiological history (contact with a patient with herpetic angina, epidemic myalgia) and laboratory data.

Specific diagnostics is aimed at the isolation of enterovirus RNA from cerebral fluid in PCR. You can use the virological method. The test material infects cell cultures and newborn mice (to isolate Coxsackie A enteroviruses).

Serological methods. The most informative are RTGA, IFA, RSK. Blood is taken in the early days of the disease and after 2-3 weeks from convalescents. A fourfold increase in antibody titer in the study of paired sera confirms the diagnosis.

There is no specific treatment for enteroviral meningitis (meningoencephalitis). Given that on the first day with enteroviral meningitis, pleocytosis in the cerebrospinal fluid is often neutrophilic and it is not always possible to solve the problem of the nature of the disease, it is necessary to give a

broad-spectrum antibiotic (ceftriaxone). Antibiotic treatment should be continued until the results of bacteriological and virological studies. It is advisable to repeat lumbar puncture after 1-2 days, which will help in verifying the diagnosis and evaluating the effectiveness of therapy. Pathogenetic therapy is aimed at combating brain hypoxia, hyperhydration by the introduction of diuretics, intoxication. With meningoencephalitis, the appointment of corticosteroids is necessary.

## SERIOUS MENINGITIS CAUSED BY BACTERIA, SPIROCHETES (TUBERCULOUS, LEPTOSPIROSIS)

In most cases, **tuberculous meningitis** develops as a result of hematogenous dissemination from primary foci (lungs, kidneys, lymph nodes, etc.). Sometimes tuberculous meningitis is the primary manifestation of tuberculosis and may be the only localization of active tuberculosis.

According to the ICD-10 classification, tuberculous meningitis occurs under the code A 17.0 + G01.

Tuberculous meningitis can occur on its own, but mainly as meningoencephalitis. Depending on the localization of the process in the central nervous system, there are various clinical variants of tuberculous meningoencephalitis, early symptoms, the course and outcome of which have their own distinctive features. Most often (85 - 90%), basal tuberculous meningoencephalitis is recorded, characterized by the localization of serous-fibrinous exudative inflammatory process in the region of the base of the brain.

For basal meningoencephalitis, a gradual onset of the disease is characteristic. In the early days, patients complain of lethargy, decreased performance and appetite, sleep disturbance, irritability, unstable subfebrile temperature. Some patients complain of dizziness, numbness of half of the face, tongue. An increase in temperature from subfebrile to 39 - 39.5 ° C is observed by the end of the 1st week and often precedes the occurrence of a headache or occurs simultaneously with it. Vomiting, as a rule, joins a headache on the 6-8th day of illness, i.e. persistent headache and vomiting are not early symptoms for this form of tuberculous meningitis. Meningeal symptoms are initially mild or absent, so patients continue to walk, and often even work. In the second week of the disease, meningeal symptoms become clear. However, in some patients with basal meningoencephalitis, meningeal symptoms remain weak and their dissociation can be observed - with pronounced stiff neck, there is no Kerning symptom and vice versa. At the 2nd week of the development of meningoencephalitis, patients are

pale. General hypersthesia is noted. Apathy, stupor, and a delirious state may increase. Patients have a weakening of memory for current events, patients cannot report an analysis of the disease, constantly lose their orientation in place and time, they often have false memories. Often the cranial nerves are affected in isolation or in combination due to compression by increasing exudate, as well as as a result of direct damage to the nerves by the inflammatory process. Paresis of the oculomotor nerve develops (ptosis, anisocoria, divergent strabismus, etc.), abduction nerve (convergent strabismus), facial nerve (drooping mouth angle, smoothing of the nasolabial fold), hyoid nerve (deviation of the tongue to the side), optic nerve (changing the eye bottom in the form of edema of the nipple, congestion, optic neuritis). The appearance of vegetative-vascular symptoms is characteristic: red dermographism, Trusso spots, bradycardia. Motor disorders also develop gradually, they are preceded by paresthesia of those limbs in which paresis and paralysis can develop in the future. Violations of tendon reflexes and muscle tone are detected. Pathological reflexes of Babinsky, Rossolimo, Oppenheim.

At the end of the second week - confusion, impaired function of the pelvic organs. In the absence of adequate treatment at the 3rd week of the disease, depression of consciousness is noted with the absence of verbal contact, but maintaining a more or less adequate reaction to pain irritations more often in the form of protective movements. Subsequently - a complete loss of consciousness and perception of the environment. Patients lie motionless, only sometimes moaning plaintively. Tendon and pupillary reflexes fade away, or decerebral rigidity develops, which is characterized by persistent hypertension of the muscles of the arms and legs: flexion and extensor, or only flexion.

In all doubtful cases, immediately, as soon as possible, a diagnostic spinal puncture is necessary. Cerebral fluid is transparent or slightly opalescent, colorless, its pressure is increased (more than 300 - 500 mm aq). Pleocytosis 100 - 600 cells in 1  $\mu$ l, with some fluctuations in one direction or another. Mixed composition pleocytosis with a marked predominance of lymphocytes (60 - 80%), protein content 1 - g / l and higher (protein-cell dissociation). The sugar content is

reduced to 0.7 -1.5 mmol / L. Pandy reaction (+++), Nonne-Apelt reaction (++++). A decrease in sugar content is often correlated with the severity of the patient's condition and may have prognostic value. When standing cerebrospinal fluid during the day may fall out in 30 - 40% of cases of fibrin mesh.

Repeated studies of cerebrospinal fluid after 3-4 days are necessary, because tuberculous meningitis is characterized by increasing protein content with persistent pleocytosis.

The severe course of the disease and fatal outcomes are mainly associated with untimely diagnosis and treatment that was started late. During therapy, the improvement trend occurs only after 3-7 days from the start of treatment. Consciousness clears up, temperature drops, vomiting stops. However, the disease has a tendency to a long, stubborn course. Gradually decreases and after 2-4 weeks the headache disappears, but, as a rule, subfebrile condition, stiff neck and the Kerning symptom persist for a long time (up to 1-5 months), changes in cerebral fluid (up to 5-6 months). Focal symptoms of damage to the central nervous system regress at different times.

The diagnosis is made on the basis of the clinical picture, data from an epidemiological history and laboratory diagnosis. Important information is about contact with a patient with tuberculosis, about a disease of tuberculosis.

Specific diagnosis. To confirm the diagnosis, a study of cerebral fluid is necessary to detect mycobacterium tuberculosis. Only 20% of patients succeed in detecting the causative agent by flotation, by sowing and infecting guinea pigs, and besides, the results have to wait up to 2 months. The absence of a pathogen in the cerebral fluid does not exclude the diagnosis of tuberculous meningitis.

Treatment of patients with tuberculous meningoencephalitis is complex. Patients should be hospitalized. In the acute period of the disease, strict bed rest should be observed. Of antibiotics, rifampicin has a good effect. Specific anti-TB drugs are used that penetrate well through the blood-brain barrier. Treatment of patients with tuberculous meningitis (meningoencephalitis) should be carried out in specialized anti-tuberculosis hospitals.



With early diagnosis and timely treatment, recovery usually occurs. With the late start of specific treatment, various residual effects (persistent paresis, epilepsy, and others) are possible.

### **Leptospirosis Meningitis**

Meningeal syndrome (meningism, meningitis) with leptospirosis is observed in 15 - 30% of patients. Meningitis can be caused by any serotype of leptospira, but is more often caused by pathogens of the serogroups Grippotyphosa and Pomona. Leptospirosis meningitis can be either serous or purulent.

According to the ICD-10 classification, leptospirosis has the code A 27, leptospirosis meningitis - A 27.8.

Meningitis in patients with leptospirosis develops, as a rule, after 5-6 days and later from the onset of the disease. In the early days of the disease, even in patients with meningeal syndrome, there may not be increased pleocytosis in the cerebrospinal fluid. With the development of meningitis against a background of high temperature and symptoms of severe intoxication, headache, pain in the eyeballs, photophobia intensifies, vomiting occurs that is not associated with food intake, agitation. On examination - positive meningeal symptoms: stiff neck, symptoms of Kerning, Brudzinsky, Fanconi and others. Cerebral fluid is often transparent, in some patients it is cloudy. The cerebrospinal fluid flows under pressure, pleocytosis is several hundred in 1  $\mu$ l, but can be lower and higher. Lymphocytes predominate in the cytogram more often, but the admixture of neutrophilic granulocytes is significant, in rare cases they even prevail. The protein content is moderately increased, sugar - reduced. Normalization of cerebrospinal fluid occurs after the disappearance of meningeal syndrome and other symptoms of the disease. In the general analysis of blood - anemia, thrombocytopenia, hyperleukocytosis (15 -20  $\times 10^9$  / l), neutrophilia with a shift of the formula to the left, accelerated to 40 - 60 mm / hour ESR. The presence of meningitis indicates a severe course of leptospirosis.

Specific diagnosis.

The isolation of the pathogen from cerebrospinal fluid and blood was not widely used microscopically and when inoculated on media, because microscopic examination of the cerebrospinal fluid often yields negative results, and when inoculated, the results are obtained late and special conditions are required in laboratories. PCR is promising when it is possible to detect the genetic material of the pathogen in the cerebrospinal fluid, which is most important for meningitis.

In the doctor's daily practice, serological diagnostic methods are used to confirm the diagnosis using the microagglutination reaction and leptospira lysis (PMAL) with live cultures of the pathogen. The patient's blood is examined for the presence of antibodies from the second week of the disease and later, because antibodies with leptospirosis are formed late, reaching a maximum titer of 4-5 weeks. Diagnostic titer 1: 100. For the recognition of "acute" and anamnestic reactions of immunity, a separate definition of antibodies of the classes of immunoglobulins M and G is used. In an acute process, antibodies of classes M circulate in the blood, with an anamnestic - class G.

The most common was the study of blood in paired serums (the first - 5-7 days of illness, the second - after 7-10 days). Even a minimal increase in antibody titer in dynamics makes it possible to confirm the diagnosis. More reliable is the increase in antibody titers 4 times or higher.

The diagnosis of leptospirosis meningitis is based on:

- \* clinical features of the disease (against the background of high fever and symptoms of severe intoxication of patients, severe pain in the muscles, especially in the calf, aggravated by palpation, may cause jaundice; hemorrhagic syndrome, signs of kidney damage);

- \* data of an epidemiological history (swimming in infected ponds, when eating products contaminated with secretions of infected rodents, working in wetlands; deratisators, shepherds, livestock workers are more likely to get sick);

- \* the presence of meningeal syndrome and the nature of cerebral fluid (increased pleocytosis);

- \* The inflammatory nature of the blood (leukocytosis, neutrophilia, shift of the formula to the left, increased ESR);

- \* the allocation of the pathogen from the blood, but mainly from the cerebrospinal fluid;

- \* the presence of a diagnostic antibody titer or an increase in antibody titer in paired sera.

Etiotropic therapy.

Benzyloxyethyl penicillin is considered the drug of choice for leptospiral meningitis due to the high sensitivity of leptospira to it, the ability to penetrate well through the blood-brain barrier and have minimal toxicity to the central nervous system, liver and kidneys. Penicillin is administered in a dose of 200 - 300 thousand units per 1 kg of patient's body weight per day for all days of fever and for 2-3 days of normal temperature. Effective ceftriaxone 2 g. 2 times a day for 7-10 days, chloramphenicol succinate 3-4 gr. per day. It is advisable to prescribe antibiotics against the background of infusion therapy and glucocorticosteroids.

Pathogenetic therapy is aimed at combating:

- \* with brain hypoxia,

- \* hyperhydration by introducing, first of all, saluretics;

- \* in the presence of thrombohemorrhagic syndrome (the initial stage of DIC - syndrome), anticoagulants (heparin) and antiplatelet agents (trental) are prescribed;

- \* intoxication (infusion therapy with the inclusion of crystalloid and colloidal solutions in a ratio of 3: 1), glucocorticoids in short courses, when the number of solutions and the dose of hormones are determined by the severity of the condition and the clinical effect);

- \* to eliminate metabolic acidosis lactosol, 4% sodium bicarbonate solution.

### **Lyme disease meningitis (Ixodes tick-borne borreliosis)**

Lesions of the nervous system with Lyme borreliosis are among the most frequent manifestations of the stage of generalization of the process.

According to the ICD 10 classification, Lyme disease has code A69.2.

Tick-borne tick-borne borreliosis refers to zoonotic natural focal vector-borne infections. In terms of prevalence, Lyme disease occupies one of the leading places among all natural focal human diseases. Infection occurs with a bite of ixodid ticks through saliva.

At the time of a tick bite, a papule appears, then annular erythema, rapidly increasing in size (diameter 5-20 cm or more) with a pale cyanotic center. Erythema is accompanied by slight itching, prone to the appearance of new spots, but smaller. In 15-20%, erythema is homogeneous without enlightenment in the center. Non-erythematous forms of the disease are also possible. The general condition of patients in the early days of the disease suffers little. Patients may complain of subfebrile temperature, weakness, headache, myalgia, arthralgia, but they do not always seek medical help.

With tick-borne borreliosis, meningitis develops only in the dissemination phase of the process after 1-2 months from the onset of the disease. When the process is generalized, foci of erythema and general intoxication symptoms reappear in various parts of the body. The temperature rises, often to febrile numbers, patients complain of headache, vomiting, weakness. On examination, positive meningeal signs are revealed: stiff neck, symptoms of Kernig, tripod "and others.

With spinal puncture - lymphocytic pleocytosis, the protein content is slightly increased. With tick-borne tick-borne borreliosis, lymphocytic pleocytosis persists for a long time for weeks even after the disappearance of clinical symptoms. In the general analysis of blood - moderate leukocytosis. Decreased platelet count, increased ESR (40 mm / hour or more). To clarify the nature and severity of the central nervous system lesion, it is desirable to conduct computed tomography.

With Lyme disease, meningitis is often combined with paresis of the facial nerves, polyradiculoneuritis (Bonnwart syndrome). In addition to meningitis,

patients can be identified: generalized lymphadenopathy, splenomegaly, heart, eye damage.

#### Specific diagnosis

Neurological lesions are more likely to occur with *B. Garinii* infection. The diagnosis is confirmed by the detection of borrelia in cerebrospinal fluid by the bacteriological method. Borrelia is cultured in KM<sub>u</sub> medium (selective trace of BSK-K5). However, the probability of detecting borrelia by the bacteriological method in biological fluids, including blood and cerebrospinal fluid, is small (less than 10%).

A promising method is PCR aimed at identifying the genetic material of borrelia. The PCR method is especially informative for diagnosis in the case of non-erythema forms of the disease.

The most informative method for the specific diagnosis of borreliosis meningitis includes serological research methods - RNIF, ELISA for the detection of anti-borreliosis immunoglobulins of the IgM and IgG class. With tick-borne borreliosis, due to the presence of some common antigens in spirochetes (causative agents of syphilis, tick-borne typhoid fever, leptospirosis and others), false-positive results are possible. The diagnostic titer in ELISA for IgM is not less than 1:64, for IgG - not less than 1: 128. Only a dynamic study (paired sera - 4-fold increase in antibody titer) allows us to convincingly verify the diagnosis. In addition, the level of anti-borreliosis antibodies with meningitis in the cerebrospinal fluid is significantly higher than in the blood. In this regard, in case of damage to the nervous system, cerebrospinal fluid is definitely determined - the serum index. In addition, positive results must be confirmed by immunoblotting. Antibodies are formed only to that serotype, the strain that caused the disease.

Etiotropic therapy. For meningitis caused by *Borrelia*, penicillin and cephalosporins are the drugs of choice. You can alternate penicillin at 200-300 thousand units / kg per day for 10-15 days with ceftriaxone 1.0 g 2 times a day intravenously for 10-14 days. The course of treatment is at least 21 days. You can prescribe drugs in turn, or combine them. If the first course of therapy did not give

the desired result, then it is recommended to conduct a second course of treatment, but with other antibacterial drugs for another 30 days.

## SERIOUS MENINGITIS CAUSED BY PROTOZOA (TOXOPLASMA MENINGITIS)

**Toxoplasmosis** is a widespread protozoal disease. About 30% of the population is infected with toxoplasma. However, among infected people no more than 1% have manifest forms of the disease. In the presence of immunodeficiency of any genesis (radiation, prolonged use of corticosteroids, HIV infection, etc.), a generalization of the process may develop with the development of meningitis, encephalitis.

The septic form of toxoplasmosis begins acutely with a rise in temperature to febrile numbers, chills, severe weakness, headache, and repeated vomiting. From the first days of the disease are characteristic:

- \* lymphadenopathy (an increase in cervical, occipital, axillary, mesenteric, paratracheal lymph nodes);
- \* an increase in the size of the liver and spleen;
- \* eye damage: chorioretinitis, when patients indicate a sudden loss of part of the visual field on one side; keratouveitis and others
- \* myositis (pain in the muscles of the limbs, especially painful muscles of the leg);
- \* heart damage.

With the development of meningitis, positive meningeal signs are detected. With spinal puncture, cerebrospinal fluid flows under high pressure. Transparent, moderate pleocytosis (tens, hundreds of cells in 1  $\mu$ l.), lymph and monocytic, the protein content is slightly increased, the sugar content is normal. In a general blood test, the number of leukocytes remains normal or is sometimes slightly reduced (leukopenia), the number of lymphocytes and monocytes is increased, atypical mononuclear cells may appear (no more than 1-2%). ESR is normal.

With the development of encephalitis in patients, confusion, delirium, hallucinations, convulsions, damage to the cranial nerves, epileptic seizures appear.

Computed tomography shows a pattern of diffuse encephalitis with one or more areas of brain tissue damage.

(in the cortex or deeper parts).

Specific diagnostics are aimed at detecting toxoplasmas in the cerebrospinal fluid when the sediment obtained after centrifugation is examined. The smear is stained according to the method of Romanovsky - Giemsa. Large smears of toxoplasma are clearly visible in smears. It is important to detect toxoplasma antigens in the cerebrospinal fluid using a polymer chain reaction.

A reliable method is the isolation of a toxoplasma culture. Liquor injected in 7-8 day old chicken embryos. In the presence of toxoplasma, whitish plaques appear in tissue cultures: infected cells and individual tachyzoites are detected with special staining on days 3-6. The method is laborious, rarely used in everyday practice.

Serological methods - detection of specific antibodies (anti TOXO IgM) in high ELISA titers. However, in most cases, the development of encephalitis is not accompanied by the appearance of specific antibodies in the blood serum. The appearance of antibodies in the cerebrospinal fluid is of some diagnostic value.

Specific therapy. Use a combination of 3 drugs (pyrimethamine in combination with folic acid and clindamycin). Pyrimethamine is prescribed on the first day of 200 mg, on the next - 75-50 mg per day, folic acid 10-20 mg every 6 hours orally or intravenously. Clindamycin 600 mg every 6 hours intravenously, then orally. The course of treatment is 3-6 weeks. Pathogenetic therapy is aimed at combating brain hypoxia, intoxication and other manifestations of the disease.



## PURULENT BACTERIAL MENINGITIS (MENINGOCOCCAL, PNEUMOCOCCAL, STAPHYLOCOCCAL MENINGITIS)

The purulent process of the meninges can be caused under certain conditions by various pathogenic microbes. However, mainly purulent meningitis is caused by a relatively small group of pathogens: meningococci, pneumococci, hemophilic bacillus Afanasiev-Pfeiffer, staphylococci, salmonella.

### **Meningococcal meningitis (meningoencephalitis)**

In 80% of cases, primary bacterial meningitis has a meningococcal etiology. The disease is registered in all countries of the world, but the highest incidence is found in Africa, the so-called "meningitis belt".

According to the ICD-10 classification, meningococcal infection is distinguished under the code A39. Meningococcal meningitis A39.0, encephalitis A39.8, acute meningococemia A 39.2.

With meningococcal infection, meningitis usually develops acutely. Patients sometimes indicate not only the day but also the time of onset of the disease. The temperature rises to 38.5-40°C, patients complain of headache in the frontotemporal, rarely in the occipital region, pain in the eyeballs, lack of appetite, vomiting not associated with eating, severe weakness. Only some patients (15%) for 2 -3 days appear prodromal symptoms in the form of nasopharyngitis. The headache increases rapidly, becomes diffuse, the pain is exacerbated by movement, turning the head, strong light and sound stimuli. There is a general hyperesthesia - hypersensitivity to all external stimuli. Any touch to the patient causes anxiety and increased pain. The phenomenon of hyperesthesia is an important symptom of purulent meningitis. A few hours after the onset of the disease, meningeal symptoms appear: stiffness of the occipital muscles, symptoms of Kernig, Brudzinski, Meitus, Bekhterev and others.

In most patients there is a decrease in abdominal and tendon reflexes, as well as their unevenness, in 3-5% of patients - are rapidly damaged cranial nerves, often oculomotor (III, IV, VI pairs) and facial nerve, rarely - sublingual. The defeat of

the cranial nerves in meningitis is reversible. Red dermographism, herpetic rashes on the lips are noted with great consistency in meningococcal meningitis. Patients are retarded, pale, the face has a suffering expression. The pulse is accelerated, the heart sounds are muffled.

The appearance of focal symptoms in the first two days after the onset of the disease indicates the development of edema-swelling of the brain. In meningococcal meningitis, edema-swelling of the brain may develop in the first hours of the disease before the formation of purulent exudate in the subarachnoid space and has a toxic genesis due to the action of lipopolysaccharide (endotoxin) meningococcus and components of generalized inflammation.

Meningococcal meningoencephalitis is much less common and is characterized by manifestations of encephalitis in combination with meningeal and general intoxication syndromes. In contrast to pneumococcal meningitis in meningococcal meningitis, the involvement of brain substances in the pathological process occurs on average 2-3 days later and the exudate contains less fibrin. In addition, the lesion is often limited to the outer layer of the cortex. At brain defeat the condition of patients worsens. There is motor excitement, convulsions, impaired consciousness. There may be mental disorders, hemi- and paraparesis. Pathological reflexes of Babynsky, Oppenheim, Rossolimo and others are positive. The process may involve the cranial nerves: oculomotor, facial, auditory and optic nerves.

At a spinal puncture characteristic changes of cerebrospinal fluid come to light. In the first hours of the disease, the cerebrospinal fluid may be transparent or slightly opalescent, but by the end of the day the cerebrospinal fluid becomes cloudy, milky white or yellowish-greenish in color. The cerebrospinal fluid flows under high pressure (300 - 500 mm Hg). However, in the case of cerebral hypotension, the pressure in the spinal canal may be normal or reduced. It can be normal in the presence of a partial block of cerebrospinal fluid. Pleocytosis from hundreds to several thousand in 1  $\mu$ l, neutrophilic (90%). The amount of protein is increased or even high (up to 1-4 g / l). High concentrations of protein in the

cerebrospinal fluid correspond to the most severe forms of meningoenkephalitis. Normalization of the protein content in the cerebrospinal fluid occurs somewhat later than the normalization of pleocytosis. The sugar content is moderately reduced. Pandy test (+++), Nonny - Apelta test (++++). Often fibrin film precipitates. In the general analysis of blood: leukocytosis ( $18-30 \cdot 10^9 / l$ ), shift of rod-shaped to 15-40%, ESR is usually raised to 40-60 mm / h. The severity of changes in the hemogram correlates with the severity of the course.

A combined form of meningococcal infection is not uncommon when meningitis is combined with meningococemia. The clinical symptoms of this form can be dominated by both manifestations of meningitis and manifestations of meningococemia (against the background of severe intoxication on the skin of the buttocks, thighs, armpits, torso there is a hemorrhagic rash of various sizes and colors).

Mortality from meningococcal infection largely depends on the clinical form of the disease. Among patients treated, meningococcal meningitis has a mortality rate of 1% because, unlike pneumococcal meningitis, the exudate contains little fibrin and the pathogen is bioavailable. Among meningitis patients treated, mortality is 1-2%; meningoenkephalitis - mortality is 3-5% and often there are late complications (epilepsy, mental retardation, deafness, blindness). With timely treatment of meningococemia - mortality is 20% or more. The main number of deaths from meningococcal infection is due to infectious - toxic shock. Endotoxin shock leads to hemodynamic disorders, primarily microcirculation, disseminated intravascular coagulation, profound metabolic disorders. In the absence of treatment, mortality reaches 100%.

Specific diagnostics.

The main method of confirming meningococcal meningitis (meningoenkephalitis) is the isolation of the pathogen from cerebrospinal fluid, blood, nasal secretions and oropharynx. The test material is inoculated on serum or blood agar. Meningococci in their growth are quite demanding not only to nutrient media, but also to temperature. Nutrient media should be heated to + 37 °C, before

sending to the laboratory the material should be stored in a thermostat also at T + 37C °, but not for long (up to 2 hours), given the instability of meningococcus in the environment. The answer from the laboratory is received not earlier than on the fourth day after sowing. Meningococcus can be detected in the test material by polymerase chain reaction (PCR). It has special value at inspection of patients at whom activators in cerebrospinal fluid and in blood by a bacteriological method are not found. Examination of the cerebrospinal fluid bacteriologically and by PCR is performed at the first puncture, preferably before the appointment of antibiotic therapy.

The bacterioscopic method of research helps to make the preliminary diagnosis. Detection of intracellular and extracellular gram-negative diplococci in the cerebrospinal fluid is an important argument in favor of meningococcal infection.

Serological methods. Detection of antimeningococcal antibodies is used for retrospective diagnosis. Blood tests are performed in paired sera with an interval of 10-12 days, because due to the severity of the disease, antibodies often appear late and their titer may not be high. An increase in antibody titer is important.

In the etiotropic therapy of meningitis (meningoencephalitis) the drug of choice is penicillin, which is prescribed at the rate of 300 thousand units. / kg of body weight of the patient per day with an interval between doses - no more than 3 hours without a night break. In the first days it is desirable to enter sodium salt of penicillin intravenously, further, at improvement of a condition of the patient, it is possible to alternate intravenous and intramuscular administration. If necessary, you can use other antibiotics:

ceftriaxone 2 g. 2 times a day intravenously,

cefotaxime 2.0 g every 6-8 hours,

ampicillin 1.0 - 1.5 g 4-6 times a day, alternating intravenous and intramuscular injection,

moxifloxacin 400 mg per day.

The course of treatment with a favorable course of the disease is at least 6 days. To control the treatment on the 7th day make a spinal tap. If in the cerebrospinal fluid pleocytosis does not exceed 100 cells in 1  $\mu$ l (preferably 30 cells in 1  $\mu$ l) and it has a lymphocytic nature, treatment with penicillin is stopped. If pleocytosis remains neutrophilic, the introduction of penicillin in the previous dose continues for another 3 days. At a long course of an illness penicillin therapy can be prolonged to 1,5-2 weeks.

For etiotropic therapy of the combined form of meningococcal infection (meningitis with meningococemia) with symptoms of infectious-toxic shock, the drug of choice is chloramphenicol succinate 1-1.5 g intravenously, then intramuscularly every 8 hours.

**Pneumococcal meningoenkephalitis** is one of the most severe forms of purulent meningitis, characterized by rapid flow and high mortality (17-20%). According to the frequency of purulent meningitis, it accounts for 30-35% of their total number.

According to the ICD-10 classification, pneumococcal meningitis is code G00.1.

The reason for such high mortality is the biological properties of pathogen and the features of pathological process caused by it. Pneumococcus has a well-organized capsule. Depending on the polysaccharides and composition, 85 pneumococcal serotypes are known, the most virulent of which are the first eight. Pneumococci produce neuraminidase, hyaluronidase, leukocidin, which dramatically increases vascular permeability. In turn, the pneumococcal capsule protects it from phagocytosis, so the pathogen quickly spreads to the substance of the brain, forming a powerful fibrinous-purulent exudate directly on the surface of the brain, and not in its membranes, as in other bacterial meningitis (meningococcal).

In the substance of the brain in 2-3 days from the onset of the disease encephalitic foci are formed, in the thickness of which pneumococcus is not

biologically available for antibiotics. This mechanism is due to the lack of clinical effect of antibiotic therapy due to the low bioavailability of the pathogen.

Pneumococcal meningoenkephalitis usually occurs a second time, followed by other manifestations of pneumococcal infection. The primary source of infection may be otitis, sinusitis, sinusitis, endocarditis, acute inflammatory diseases of the upper respiratory tract, pneumonia. The factor is fractures of the skull base, accompanied by cerebrospinal fluid, open traumatic brain injury. At the same time in some cases the primary center cannot be established even pathologically.

The onset of meningoenkephalitis is always acute. Body temperature in the first hours of the disease reaches febrile figures of 39° - 40° C, but in very severe cases may remain subfebrile. There is chills, sharp headache, dizziness, vomiting, photophobia, severe hyperesthesia, hyperacusis, severe weakness. Positive meningeal symptoms (stiffness of the occipital muscles, symptoms of Kernig, Brudzinski, Matus, Fanconi and others). From the first day of the disease, there is a sharp psychomotor agitation, convulsions, tremors of the extremities, impaired consciousness. Early focal symptoms of craniocerebral nerves appear, more often oculomotor, abductor, facial (nystagmus, strabismus, asymmetry of facial innervation and others). Mono - and hemiparesis of extremities are possible. Pathological reflexes of Babinski, Oppenheim, Rossolimo and others can appear.

On day 3-4 of the disease in most patients on the lips, oral mucosa there are herpetic rashes. Occasionally there is a small hemorrhagic rash, different in nature from the rash in meningococcal disease: it is smaller but more abundant. The rash is always observed in patients with septic disease.

In the general analysis of blood: leukocytosis, aneosinophilia, neutrophilia with a sharp shift of the neutrophilic formula to the left, ESR is accelerated to 40 - 60 mm / h, moderate anemia and thrombocytopenia are possible.

Cerebral fluid is cloudy, often greenish-gray. When standing, a precipitate falls out. In pneumococcal meningitis, there is almost always a violation of cerebrospinal fluid tests, which indicates a partial block of the cerebrospinal fluid

and the consolidation of pus in the subarachnoid space. Pleocytosis of neutrophilic nature (80 - 90% - neutrophils. 10 - 20% - lymphocytes) with a cell number of 1000 or more in 1  $\mu$ l. The protein content is usually high - from 1 to 16 g / l and more, the sugar content (2.0-2.1 mmol / l) is reduced. The reaction of Panda and Nonna-Apelta (++++) is positive.

The most difficult and prognostically unfavorable pneumococcal meningoencephalitis with low cytosis (200-500 cells in 1  $\mu$ l) and sharply increased protein content (6-25 g / l).

Without treatment in most cases on day 5-6 of the disease is fatal. Even with timely treatment, the disease can take a long wave.

In some patients who have suffered from pneumococcal meningoencephalitis, there may be residual effects in the form of prolonged asthenia, persistent preservation of paresis, delayed psychomotor development.

The diagnosis of pneumococcal meningoencephalitis is made on the basis of the clinical picture of the disease, life history (presence of the primary source of infection) and isolation of the pathogen from the cerebrospinal fluid. In the first days of the disease, the pathogen can be detected in the cerebrospinal fluid.

At a bacterioscopy detection of gram-positive diplococci of the lanceolate form surrounded by a capsule gives the basis for preliminary diagnosis. In order to isolate a pure culture, blood and cerebrospinal fluid are inoculated on blood or serum agar. On nutrient media, pneumococcus gives rise to small transparent colonies. You can use a biological sample. For this purpose, the test material is infected intraperitoneally to white mice.

In pneumococcal meningoencephalitis, the effectiveness of treatment is largely determined by the full rehabilitation of the primary source of infection and early appointment of antibiotics. Selection of an adequate antibiotic is quite difficult, because in recent years more than 30% of pneumococcal strains are resistant to penicillin, 65% - tetracycline, increasing the number of strains insensitive to cephalosporins. It is noted that 95% of nosocomial pneumococcal infection is caused by antibiotic-resistant pathogens.

In cases where the etiology of purulent meningitis has not yet been clarified, generation III and IV broad-spectrum antibiotics are shown to penetrate well through the blood-brain barrier with minimal toxicity to the central nervous system. At penicillin-sensitive pneumococcal meningitis appoint sodium salt of penicillin intravenously at the rate of 300 thousand units per 1 kg of body weight of the patient per day (at a patient's weight of 80 kg - 24 million units per day). Only with intravenous administration of the drug can quickly provide the required concentration of benzylpenicillin in the cerebrospinal fluid. The drug is administered with an interval of 3 hours. In the following days it is possible to alternate intravenous and intramuscular administration of penicillin. Penicillin is prescribed in combination with ceftriaxone 2 g 2 times a day. Effective vancomycin 1.0 g 2 times a day in combination with cefotaxime 2.0 g every 6-8 hours.

The reserve drug is chloramphenicol - succinate. Chloramphenicol - succinate is administered intravenously 1.0-1.5 g every 8 hours, in the following days when the condition improves 1.0 g every 8 hours intramuscularly. It is active against pneumococcus and is found in sufficient concentration in the cerebrospinal fluid within 2 hours after parenteral administration. Due to possible antagonism, it is not recommended to combine penicillin with chloramphenicol.

In penicillin-resistant pneumococcal meningitis, the drugs of choice are:

meropenem 2.0 g every 8 hours;

moxifloxacin 40 mg per day;

linezolid 600 mg in combination with rifampicin 600 mg every 12 hours

The duration of antibiotic therapy is 12-14 days. The indication for the withdrawal of antibiotics is a decrease in pleocytosis in the cerebrospinal fluid below 30 cells in 1  $\mu$ l, with a clear predominance of lymphocytes.

Pathogenetic therapy is aimed at combating cerebral hypoxia, intoxication, be sure to prescribe diuretics: saluretics (lasix) and osmодиuretics (mannitol solutions). When reducing the level of albumin should be used as an osmotic



dehydrating drug concentrated 20% solution of albumin with high osmotic pressure.

In the period of early convalescence prescribe drugs that improve microcirculation in the vessels of the brain (trental for 3-4 weeks), drugs that normalize the processes of tissue metabolism of the brain (cavinton, piracetam). Polyvitamins.

**Staphylococcal meningitis** accounts for 3-5% of the total incidence of purulent meningitis.

According to the ICD-10 classification, staphylococcal meningitis is code G00.3.

Staphylococcal meningitis is usually secondary. Pathogenetically distinguish contact and hematogenous forms of staphylococcal meningitis. Contact forms arise as a result of contact transition of inflammatory process to meninges at suppuration of subdural hematomas or purulent otitis. Hematogenous forms are observed in patients with lung abscess, septic abortions, purulent diseases of the skin and subcutaneous tissue (panaritium, boils, carbuncles). They are especially difficult because they are always manifestations of the septic process.

With the development of meningitis, the condition of patients deteriorates. There is a severe headache, dizziness, severe weakness, loss of appetite, vomiting, which does not bring relief, sleep disturbances. General hyperesthesia is sharply expressed. The temperature is febrile - 38.5 - 40.5°C. Patients are adynamic, lethargic, reluctant to come into contact. Meningeal signs (stiffness of the occipital muscles, symptoms of Kernig, Brudzinski and others) are positive. The process can be limited to the defeat of the meninges.

Staphylococcal sepsis is characterized by a predisposition to abscesses. If staphylococcal meningitis was one of the manifestations of the septic process, then in all organs, including the brain, there are clearly limited purulent cavities. Focal symptoms are determined by the location of abscesses. The disease is severe, there

is a tendency to prolonged course. The main number of deaths in staphylococcal sepsis is due to infectious - toxic shock and is 20% or more.

At a spinal puncture characteristic changes of cerebrospinal fluid come to light. The cerebrospinal fluid flows under high pressure, turbid. Pleocytosis from hundreds to thousands in 1  $\mu$ l, neutrophilic (85 -90%), increased protein content, reduced sugar content, Pandie reaction (+++), Nonni-Apelta (++++).

In the general analysis of blood - high leukocytosis, neutrophilia, shift of the formula to the left, accelerated ESR.

Specific diagnostics.

The main method of specific laboratory research is aimed at identifying the pathogen in the cerebrospinal fluid. Cerebrospinal fluid cultures are performed on meat peptone agar. Staphylococcus aureus (Staph.aureus) is of the greatest importance in pathology. When grown on solid nutrient media, it produces carotenoids, which color the colonies golden. All strains of staphylococci that produce coagulase are called golden because coagulase activity is the main test for pathogenicity of the pathogen. When isolating staphylococcus determine not only the phagotype and its ability to coagulate plasma, but establish lecithinase activity, toxigenicity and resistance to various antibiotics.

Auxiliary methods are the determination of the increase in agglutinin titers with auto- and highly agglutinative strains in paired sera taken at intervals of 10 days.

In staphylococcal meningitis, the effectiveness of treatment is largely determined by the complete remediation of the primary source of infection and the early appointment of antibiotics. It is important to detect and surgically remove pus from septic foci (abscesses). When prescribing antibiotics, their resistance should be taken into account.

Prior to the study of the antibioticogram, it is advisable to treat with a combination of 2 antibiotics with a broad spectrum of action. Oxacillin intravenously or intramuscularly 2 g 4 times a day. Ceftriaxone 2 g 2 times a day. The duration of therapy is 2-3 weeks. While maintaining the high sensitivity of

staphylococcus to lincomycin, it is prescribed intravenously in 600 mg. In 250 ml of isotonic sodium chloride solution every 8 hours - to enter slowly over an hour.

Vancomycin is also effective when administered intravenously in 1 g 2 times a day slowly, no faster than 1 hour. However, the drug is ototoxic. Antibiotics should be combined with immunotherapy - antistaphylococcal immunoglobulin, antistaphylococcal plasma. These drugs are prepared from the blood of donors immunized with staphylococcal toxoid. Hyperimmune antistaphylococcal immunoglobulin is available in ampoules of 3-5 ml, which contain 100 IU of specific antibodies. The course of treatment - 5 injections. Pathogenetic therapy is aimed at combating cerebral hypoxia, hyperhydration by diuretics, intoxication.

## COMPLICATIONS

**Brain Swelling (brain edema)** is a reactive dynamic process caused by damage to the blood-brain barrier, cerebral circulatory disorders with secondary metabolic disorders, water-salt metabolism and extracellular water accumulation in the cells, which is manifested by a syndrome of increased intracranial pressure, a significant increase in brain volume and dysfunction of nerve centers.

Swelling and edema are stages of development of a complex pathological process, which is difficult to distinguish by the time of their occurrence. Brain edema, which is an accumulation of free fluid in the interstitial space, predominates in the onset of brain edema, whereas swelling or intracellular edema joins later.

The main pathogenetic link in the development of brain edema in meningitis and meningoencephalitis is damage to brain microcapillaries by bacterial endotoxins, viruses, fungi, inflammatory mediators and proteolytic enzymes. This process causes an increase in the permeability of the blood-brain barrier (BBB) for osmotically active particles - plasma proteins with the development of interstitial edema and impaired perfusion of the brain parenchyma.

The blood-brain barrier is a complex morphofunctional complex that selectively restricts the exchange of molecules and ions between the peripheral blood and the CNS, providing support and regulation of neuronal homeostasis. The morphological basis of the blood-brain barrier are capillary endothelial cells, which are located on its basement membrane and interact with each other through a complex network of tight contacts. Capillary endothelium, the blood-brain barrier, in contrast to peripheral capillaries, has a smaller pore size, so it is not permeable to large molecules and relatively impermeable to small but polar molecules - Na<sup>+</sup> ions, but easily permeable to water molecules. This makes the brain tissue sensitive to changes in blood plasma osmolarity. You can calculate the osmolarity of the blood by the formula:

$R_{osm} = 1.86 \times (\text{blood sodium concentration}) + (\text{blood glucose concentration}) + (\text{blood urea concentration}) + 5.$

Normally, the osmolarity of blood plasma is about 285 - 295 mosm / liter. Minor fluctuations in this indicator lead to significant movements of water along the osmotic pressure gradient.

Increased permeability of the blood-brain barrier in neuroinfections for blood proteins leads to their accumulation in the interstitial space with a subsequent increase in osmotic pressure in the interstitium, where the fluid is directed from the vascular bed. Interstitial edema, which develops due to an increase in the volume of the brain parenchyma, leads to an increase in intracranial pressure (ICP) and a decrease in partial perfusion pressure (the difference between mean blood pressure and ICP), which ultimately leads to impaired perfusion of brain tissue - hypoxia.

The brain is sensitive to hypoxia as it consumes almost a quarter of all oxygen in the body, and its reserves in the central nervous system (CNS) are virtually absent. Hypoxia triggers the process of anaerobic glycolysis, which is less energy efficient and leads to metabolic acidosis. Energy deficiency and metabolic shifts cause dysfunction of the ionic  $K^+ - Na^+$  pump, increased permeability of cell membranes of neurons and neuroglia for ions  $Na^+$ ,  $H^+$ ,  $Ca^{2+}$ , proteolytic enzymes and toxic substances. The ion pump is unable to remove  $Na^+$  ions from the cell and introduce  $K^+$  ions from the interstitium. Excess  $Na^+$  ions, underoxidized products of glucose metabolism leads to an increase in intracellular osmotic pressure, resulting in fluid from the vascular bed is directed into the cell and develops swelling of brain cells. Tissue edema causes a further increase in hypoxia and intracellular acidosis, activation of intracellular enzymatic systems of lysosomes, which ultimately leads to neuronal death and neuroglia.

Disorders of neurotransmitter metabolism play a special role in the development of brain edema. Damage to neuroglia and neurons leads to disruption of metabolism and inactivation of mediator amino acids, the accumulation of so-called "false mediators", disruption and distortion of nerve impulse transmission, as

well as interneuronal inconsistencies. The CNS begins to be dominated by excitation processes, which are clinically manifested by symptoms of psychomotor excitation of patients. Increased permeability of neuronal membranes in combination with damage to neuroglia leads to extracellular accumulation of K<sup>+</sup> ions, which causes depolarization of the membranes of neighboring cells and the creation of foci of hyperactivity of neurons, which is clinically manifested by convulsive syndrome. Psychomotor agitation, convulsive syndrome in conditions of hypoxia and brain edema increases the body's energy expenditure, contributes to the further progression of energy deficiency and hypoxia, which significantly exacerbates CNS damage, forming the first "vicious circle".

Intracellular and interstitial edema of neurons, as well as neuroglia violates a certain ratio of the main components of the brain due to:

- increase in the volume of the brain parenchyma;
- imbalance between the processes of production and sorption of CSF in favor of cerebrospinal fluid production;
- violation of venous outflow due to compression of cerebral venous vessels and the deposition of venous blood in the cranial cavity.

The above processes contribute to the progressive increase in ICP, as there is no possibility of increasing the size of the skull. The increase in IOP leads to a further decrease in partial perfusion pressure, and hence to a decrease in arterial blood flow with the formation of the second "vicious circle".

Lack of timely etiological and pathogenetic treatment of brain edema causes death, the causes of which are:

- 1) wedge of the brainstem into the large occipital foramen, compression and dysfunction of the brainstem;
- 2) the death of the stem structures and / or the central regulator, which occurs when the cerebral perfusion pressure drops below 10 mm Hg.

Clinic. In the early stages, the diagnosis of brain edema is difficult due to the predominance of patients with neuroinfections typical symptoms that characterize this pathology: general intoxication, cerebral and meningeal syndromes.

The main clinical symptoms of brain edema are:

- violation and / or deepening of disturbance of consciousness;
- psychomotor arousal;
- strengthening of cephalgia of a bursting character;
- the appearance of repeated vomiting, which does not bring relief;
- dizziness, intensified at the slightest movement;
- tachycardia, which turns into bradycardia, increased blood pressure;
- shortness of breath;
- aggravation and / or appearance of focal neurological symptoms;
- symptoms of brain stem damage;
- pronounced meningeal symptoms.

Classification of disturbance of consciousness:

- stunning - moderate and deep
- sopor;
- coma I (superficial coma);
- coma II (deep coma);
- coma III (extraterrestrial coma).

*Moderate stunning.* The patient is sleepy, disoriented in time and space, personality-oriented. Retro- and anterograde amnesia. Productive language contact is preserved. Opens eyes to the addressed language. Answers the questions briefly, with a delay. Executes commands correctly, slowly. Sluggish, quickly depleted. Responds to pain with purposeful movements of the extremities.

*Deep stunning.* Sharp drowsiness. Motor excitation is possible. Productive language contact is severely hampered and limited. Repeated appeals, loud exclamation in combination with the use of painful stimuli are required to establish contact. Complete disorientation. Only "yes" and "no" answer the question. Executes only simple commands. Instantly depleted, the reaction is sharply slowed down. Responds to painful stimuli with purposeful movements of the extremities.

*Sopor.* There is no productive language contact with the patient. May moan, make incomprehensible sounds. Does not execute commands. Unconsciously opens his eyes to scream, painful stimuli. Responds to painful stimuli with purposeful movements of the extremities, grimaces on the face. Reflexes are preserved. Pupils are narrow, the reaction to light is preserved. Breathing is more like Cheyne-Stokes. Tachycardia, normotony.

*Coma I (superficial coma).* It is characterized by compression of the structures of the midbrain and is characterized by further depression of consciousness and an increase in focal neurological symptoms. The patient has no reactions to external stimuli, except for severe pain in the form of uncoordinated, not aimed at eliminating the stimulus movements (flexion, extension movements in the extremities) or facial expressions of suffering, no productive contact. Abdominal reflexes are preserved, tendon - increased. There are reflexes of oral automatism and pathological foot. Muscle tone decreases. Periodically there are spasms of the muscles of the face, upper extremities, as well as fibrillar twitching of the muscles of the shoulder girdle. Mydriasis, no reaction to light, the corneal reflex is sharply reduced. Tachypnoe. Tachycardia with a tendency to normocardia, hypertension or normotension.

*Coma II (deep coma).* It is characterized by the absence of any reactions to any external stimuli, including pain. Complete absence of spontaneous movements. Various changes in muscle tone from hypotension to decerebration rigidity. Hyporeflexia or areflexia. Miosis, no reaction to light, no corneal reflex. The eyeballs are not mobile. Arrhythmic breathing with periodic apnea. Bradycardia, moderate hypotension. Pelvic dysfunction.

*Coma III (extracorporeal coma).* It is characterized by a catastrophic state of vital functions due to damage to the structures of the medulla oblongata. At patients the extreme mydriasis with lack of reaction to light is found, eyeballs are motionless. Total areflexia, complete muscle atony. Shallow breathing. Arrhythmia, severe arterial hypotension.

Clinic of wedge syndromes.



Sharp cerebrospinal fluid disorders in the conditions of increase of intracranial pressure at brain edema create conditions for shift of separate brain structures in relation to a demarcating cavity of a skull by formation of a dura mater which final result are syndromes of wedge. In the practice of the clinician, the two most common levels of wedging: wedging in the notch of the cerebellar tent and wedging into the large occipital foramen.

1. Wedge in the notch of the cerebellar tent ("upper" wedge). Occurs due to displacement, protrusion under the tent of the basal parts of the temporal lobe and leads to compression, infringement of the anterior part of the brainstem. There are 3 stages: diencephalic-mesencephalic, mesencephalic (transient) and bulbar stage.

*Diencephalic stage is characterized by:*

- flickering consciousness with deepening suppression of consciousness to stun;
- a pronounced increase in focal symptoms;
- pupils are symmetrical, slightly narrowed, photoreaction is weakened;
- tendon reflexes are preserved;
- moderate tachypnea, tachycardia, hypertension, tendency to hyperthermia.

*Mesencephalic (transitional) stage is characterized by:*

- progressive depression of consciousness (sopor, coma);
- focal symptoms that were previously detected persist;
- anisocariasis (dilation of the pupil on the side of the pathological focus and narrowing on the opposite side), the photoreaction is suppressed, especially on the side of the focus;
  - the eyeballs are motionless, there is paresis of the look up or strabismus, sometimes there is nystagmus;
  - disorders with sweeping chaotic movements, followed by hemiparesis side opposite the dilated pupil;
  - tonic extension of the legs in the flexion position of the arms (reaction to pain);
  - hyperreflexia, the presence of bilateral pathological reflexes;

- dysfunction of the pelvic organs;
- breathing like Cheyne-Stokes or Biot, severe tachycardia, severe hyperthermia and hypertension, persistent acute hyperhidrosis.

*Bulbar stage is characterized by:*

- deep or terminal coma;
- focal symptoms detected previously not determined;
- anisokarii is replaced by bilateral mydriasis, photoreaction is extremely weakened or absent;
- severe strabismus;
- atony, extensor posture without reaction to painful stimuli;
- hypo- or areflexia, bilateral pathological reflexes;
- pelvic dysfunction persists;
- bradypnea, increasing tachycardia, acute hypertension, severe hyperthermia, persistent acute hyperhidrosis.

2. Insertion into the large occipital opening ("lower" inlet). Occurs due to the displacement of the cerebellum down and leads to compression of the medulla oblongata behind and on the sides at the level of the roots of lingual-pharyngeal, vagus, accessory and sublingual nerves. Insertion into the large occipital foramen is clinically characterized by:

- progressive suppression of consciousness to a deep coma;
- mydriasis with maximum dilation of the pupils, no photoreaction;
- eyeballs are motionless, there is no oculocephalic reflex;
- atony of the extremities; areflexia, lack of pathological reflexes;
- dysfunction of the pelvic organs;
- increasing bradypnea, bradycardia, hypotension, hypothermia.

Diagnosis.

Difficulties in the diagnosis of brain edema, especially in the early stages, due to the lack of specific clinical symptoms. Diagnosis of brain edema is based on clinical examination data and additional research methods.

1. At research of a fundus, stagnant changes of disks of optic nerves which are characterized by indistinctness of their borders with the phenomena of pericapillary hypostasis, convolution of vessels of a retina, hypotension and sharp varicose veins come to light.

2. Highly informative are the methods of neuroimaging, such as computed tomography of the brain, which allows to detect a decrease in the density of the brain substance, to assess the severity of edema, its prevalence. However, a more informative method of diagnosis is nuclear magnetic resonance imaging, which determines the areas of hyperhydration of the brain parenchyma.

*Treatment I. General methods:*

- establishment of central venous access to control central venous pressure (CVP);
- catheterization of the bladder to control diuresis;
- installation of a nasogastric tube for enteral nutrition, as well as prevention of aspiration;
- the main end should be raised at an angle of 30 ° to improve venous outflow and reduce the hydrostatic pressure of the cerebrospinal fluid.

*II. Etiotropic therapy.*

*III. Pathogenetic therapy.*

1. Antihypoxic therapy:

- a) infusion of humidified oxygen through a nasal catheter;
- b) timely intubation of the trachea with transfer of the patient to artificial lung ventilation in the mode of moderate hyperventilation with partial pressure CO<sub>2</sub> 30-35 mm Hg, indications for which are:
  - lack of spontaneous breathing;
  - violation of lung ventilation with persistent changes in blood gas composition (increase in partial pressure of CO<sub>2</sub> and decrease in partial pressure of O<sub>2</sub> below 100 mm Hg, oxygen saturation of oxygen below 80%) and clinical manifestations of respiratory failure (tachypnea, bradypnea, arrhythmic respiration,

pathological types of respiration), accession of severe pneumonia, generalized convulsions, which are eliminated only by muscle relaxants.

### 2. Prevention of circulatory failure.

a) with the deterioration of myocardial contractility and decreased cardiac output use the sympathomimetics dopamine (dopamine) at a dose of 10-25  $\mu\text{g} / \text{kg} / \text{min}$ ;

b) at also hyperdynamic reactions of blood circulation without disturbance of the conductivity caused by excessive tachycardia and decrease in cardiac output use cardiac glycosides - strophanthin

### 3. Improving the rheological properties of blood and microcirculation, restoration of acid-base status (KOS):

a) to reduce platelet aggregation and improve venous outflow, solutions of pentoxifylline 0.3 g / day IV drip, euphylline 2.4% to 10.0 ml IV jet slowly for 5-6 minutes, vinpocetine 10 - 20 mg / day in / in drip at a rate of up to 80 drops / min.

b) to improve the rheological properties of the blood and coagulation disorders, heparin is administered 20 - 80 thousand IU / day, as well as protease inhibitors 500 - 1000 IU / kg IV drip under the control of the cogulogram;

### 4. Reducing the body's need for oxygen.

a) in order to alleviate psychomotor agitation, convulsive syndrome, as well as increase the resistance of the brain to hypoxia in / in enter solutions of 20% sodium oxybutyrate up to 200 mg / kg per day, 0.5% sibazone up to 80 - 100 mg / kg per day, 0, 5% of thiopental sodium 5 - 10 mg / kg, with a transition to a maintenance dose of up to 4 mg / kg for up to 2 days, 2.5% aminazine 2 4 mg / kg i / m 3 times a day, 0.25% droperidol 5 - 15 mg / kg.

b) in order to enhance glucose utilization, improve blood flow in the area of hypoxia and ischemia - 20% solution of piracetam up to 6 g / day iv.

c) the use of craniocerebral hypothermia.

### 5. Anti-edema therapy.

a) Dehydration therapy in the first few days should be carried out with a negative water balance, in the following days - zero.

b) Osmodiuretics are prescribed with caution when the osmolarity of blood plasma is not higher than 320 mosm / l and under the control of intracranial pressure, as they are characterized by the phenomenon of "recoil".

- 10 - 15% mannitol solution is administered intravenously at a drip dose of 0.5 - 1 g / kg. Half the dose is administered at a rate of 200 drops per minute, then the infusion rate is reduced to 30 drops per minute;

- hypertonic sodium chloride solution (2%, 3% and 7.5%) is administered intravenously at a rate of 1-2 ml / kg / h under the control of central venous pressure;

- sorbitol is a combined high-osmolar solution that has the properties of osmодиuretics and hyperosmolar crystalloids, which leads to the smoothing of the side effects of osmодиuretics. The maximum daily dose is 1.5 g / kg / day, the maximum rate of administration is 0.5 g / kg / h;

- hydroxyethyl starch in hypertonic 7.5% sodium chloride solution (HEC), which is also a combined preparation containing hyperosmolar crystalloid solution in combination with a colloidal solution, the advantage of which is the prolongation of the dehydration effect. Apply up to 100 ml of this solution to control intracranial pressure.

- glycerin is the safest of osmодиuretics, administered 1 g / kg h through a gastric tube;

c) Saluretics:

- furosemide 2-4 / kg per day intravenously

d) Glucocorticosteroids: 10-15 mg / kg of prednisolone or 0.3 mg / kg per day of dexamethasone.

e) Carbonic anhydrase inhibitors that eliminate cerebrospinal fluid overproduction: - diacarb 0.25 - 0.5 g / day for two weeks.

### 6. Detoxification therapy

The volume of injected fluid is calculated by the formula:

$V = P * 35 \text{ ml} - 200 \text{ ml} + (t^{\circ} \text{C} - 37^{\circ} \text{C}) * P * 3 \text{ ml} / \text{kg}$ , where

P - body weight of the patient;

35 ml - daily fluid requirement per 1 kg of body weight;

200 ml - endogenous water production due to metabolic processes;

3 ml / kg - loss by evaporation from the skin surface and with perspiration when the body temperature rises by 1 ° C.

The main objective of infusion therapy is to maintain plasma osmolarity above cerebrospinal fluid osmolarity to prevent the progression of brain swelling. Crystalloid and colloidal solutions in a ratio of 3:1 are used for detoxification infusion therapy. It is necessary to begin with introduction of colloidal solutions, then apply crystalloid solutions.

Among the crystalloid solutions, preference should be given to saline, which does not reduce the osmolarity of blood plasma - saline, Ringer's solution, isotonic glucose solution.

Among colloidal solutions, preference is given to solutions of hydroxyethyl starch - refortan, stabizol, gelofuzzin, which have a more pronounced volemic effect, less reactogenic and less prone to migration into the interstitium, in contrast to albumin, dextrans.

## Multilevel situational tasks

### Task №1

Patient V., got sick acutely: T - 39.5°C, headache, weakness, dry pertussis. The face is hyperemic, the sclera is injected. Abundant granularity is on the back pharyngeal wall. Vesicular respiration, with a hard tinge, no wheezing. Heart tones are muffled. blood pressure - 100/70 mm Hg. Liver and spleen is not palpable. Positive symptom of Kernig on the right. At puncture: cerebrospinal fluid flows rapidly, colorless, cytosis - 6 cells in 1 µl, lymphocytes, protein 0.3 g/l, sugar 3.2 with blood sugar 6 mmol.

General blood test: leukocytes  $3,5 \times 10^9 / l$ , rod-shaped 12%, segmental 38%, lymphocytes 41%, monocytes 9%, ESR 10 mm per hour.

1. Preliminary diagnosis:

- A. Influenza, severe course, serous meningitis;
- B. Influenza, severe course, purulent meningitis;
- S. Influenza, severe course, meningism;
- D. Influenza, severe course, meningoencephalitis;
- E. Influenza, severe course, encephalitis.

2. A positive symptom of Kernig is:

- A. Impossibility to unbend the lower limb in the knee joint, with preliminary bending of the limb in the knee and hip joint at an angle of 90 °;
- B. Impossibility to reach the edge of the chin to the edge of the sternum with passive bending of the neck;
- C. Bending of the lower extremities in the knee joint and pulling them to the abdomen when pressing the edge of the palm on the suprapubic symphysis;
- D. Bending the leg at the knee joint and pulling it to the abdomen while compressing the quadriceps muscle of the other lower limb;
- E. Impossibility to sit down independently with unbent and fixed knees.

3. The diagnostic titer for serological influenza testing is:

- A. 1: 100;

- B. 1: 200;
  - C. increase in titers 4 or more times in paired sera;
  - D. 1: 40-1: 80;
  - E. 10 IU / ml.
4. The modern etiotropic drug for the treatment of influenza A is:
- A. Remantadin;
  - V. Novirin;
  - S. Amizon;
  - D. Oseltamivir;
  - E. Hyperimmune influenza immunoglobulin.
5. For specific prevention of influenza use:
- A. Vaccine;
  - B. Oseltamivir;
  - S. Remantadin;
  - D. Oxacillin unguent;
  - E. Zanamivir.

**Task №2.**

Patient K., 27 years old, complains of fever for 8 days from 37.5 °C to 39.5°C, headache, sleep disturbances, loss of appetite, severe weakness. Hospitalized. The patient is retarded, comes into contact with reluctance. On examination: the face is pale, the skin is dry, hot, on the skin of the upper abdomen are three roseolas. The throat is calm. The tongue is dry, covered with a gray plaque with imprints of teeth on the edges. Vesicular respiration, no wheezing. Heart sounds are muffled, pulse 80 beats / min. at T - 39.8°C, blood pressure - 100/70 mm Hg. The abdomen is moderately bloated. In the right iliac region there is a reduction of percussion sound. The liver along the midclavicular line protrudes by 2 cm, moderate density, painless. Spleen + 1 cm. There are positive symptoms of stiffness of the occipital muscles and the upper Brudzinski symptom. Pasternatsky's symptom is negative.



General blood test: erythrocytes  $3.7 \times 10^{12}/l$ , leukocytes  $2.9 \times 10^9/l$ , rod nuclear 13%, segmental 63%, lymphocytes 20%, monocytes 4%, ESR - 15 mm per hour. A spinal puncture was performed: the cerebrospinal fluid flows under pressure, transparent, cytosis 5 cl. in 1  $\mu$ l, lymphocytes, protein - 0.3 g/l, glucose - 2.5 mmol/l with blood glucose 5.0 mmol/l.

1. Preliminary diagnosis:

- A. Typhoid fever, severe course, purulent meningitis;
- B. Typhoid fever, severe course, typhoid status;
- C. Typhoid fever, severe course, meningism;
- D. Typhoid fever, severe course, meningoencephalitis;
- E. Typhoid fever, severe course, edema-swelling of the cerebrum.

2. Brudzinski's upper symptom is:

- A. Impossibility to unbend the lower limb in the knee joint, with preliminary bending of the limb in the knee and hip joint at an angle of  $90^\circ$ ;
- B. Impossibility to reach the edge of the chin to the edge of the sternum with passive bending of the neck;
- C. Bending of the lower extremities in the knee joint and pulling them to the abdomen when pressing the edge of the palm on the suprapubic symphysis;
- D. Bending the leg at the knee joint and pulling it to the abdomen while compressing the quadriceps muscle of the other lower limb;
- E. Flexion of the lower extremities in the knee joint and pulling them to the anterior abdominal wall with passive bending of the neck and trying to get the edge of the chin to the sternum.

3. Reduction of percussion sound in the right iliac region is:

- A. Padalka's symptom;
- B. Meitus symptom;
- C. Fanconi's symptom;
- D. Voskresensk's symptom;
- E. Courvoisier's symptom.

4. What biological fluid and medium is used to verify typhoid fever in the first week of the disease:

- A. blood, Rapoport medium;
- B. urine, feces, Rapoport medium;
- C. blood, urine, feces, bile, Rapoport medium;
- D. bile, Rapoport medium;
- E. blood, blood agar.

5. The etiotropic antibacterial drug for the treatment of typhoid fever:

- A. Chloramphenicol succinate;
- B. Azithromycin;
- C. Moxifloxacin;
- D. Tobramycin;
- E. Tienam.

### **Task №3.**

Patient A., 17 years old, became acutely ill for two weeks. T - 37.2°C - 38.0°C, headache, weakness, itching, burning and rash on the external genitalia. Rash in the form of papules and vesicles. Inguinal lymphadenitis.

Due to the deterioration the patient was hospitalized. Temperature - 39.8°C, headache, vomiting, general hyperesthesia. Positive symptoms of Kernig, Brudzinski lower. The cerebrospinal fluid is transparent, follows fast drops, cytolysis 121 cells in 1 µl, neutrophils 35%, lymphocytes - 65%, protein - 0.4 g/l, glucose - 3.2 mmol/l, the Pandie reaction +.

1. Preliminary diagnosis:

- A. Serous meningitis caused by herpes simplex virus type 1;
- B. Serous meningitis caused by herpes simplex virus type 2;
- C. Serous meningitis caused by herpes simplex virus type 3;
- D. Encephalitis caused by herpes simplex virus type 1;
- E. Encephalitis caused by herpes simplex virus type 2.

2. Headache, vomiting, general hyperesthesia are the symptoms of:

- A. General intoxication syndrome;

- B. Meningeal syndrome;
  - C. Cerebral syndrome;
  - D. Encephalic syndrome;
  - E. Vestibulo-atactic syndrome.
3. Brudzinski's lower symptom is:
- A. Impossibility to unbend the lower limb in the knee joint, with preliminary bending of the limb in the knee and hip joint at an angle of 90 °;
  - B. Impossibility to reach the edge of the chin to the edge of the sternum with passive bending of the neck;
  - C. Bending of the leg extremities in the knee joint and pulling them to the anterior abdominal wall when pressing the edge of the palm on the suprapubic symphysis;
  - D. Bending the leg at the knee joint and pulling it to the abdomen while compressing the quadriceps muscle of the other lower limb;
  - E. Flexion of the lower limb in the knee joint and pulling them to the anterior abdominal wall when trying to unbend the other lower limb in the knee joint.
4. For diagnosis neuroinfections of herpetic etiology use:
- A. PCR method, DNA detection from cerebrospinal fluid;
  - B. PCR method, detection of RNA of the pathogen from cerebrospinal fluid;
  - C. PCR method, detection of DNA of the pathogen from the blood;
  - D. PCR method, detection of RNA of the pathogen from blood;
  - E. Increase in blood titer of antibodies in 4 times and more in reaction PGA.
5. The etiotropic drug for the treatment of this patient:
- A. Acyclovir 10 mg/kg intravenously every 8 hours;
  - B. Acyclovir per os 800 mg three times a day;
  - C. Acyclovir per os 400 mg every 3 hours;
  - D. Valacyclovir 1000 mg three times a day;
  - E. Ganciclovir 10 mg/kg intravenously every 12 hours.

**Task №4.**

Patient A., became acutely ill: T - 37,8°C, headache, weakness. On the second day of the disease T - 38.5°C, pain when swallowing, itchy skin. On the

skin of the face, torso on an unchanged background appeared red spots, papules, vesicles. The next day, similar elements appeared on the scalp, on the skin of the hands and feet, except for the palms and soles.

On the oral mucosa - vesicles. Rhythmic heart tones, blood pressure - 100/60 mm Hg. On the 5th day of the disease there are no new backfills, T - 36.7°C, no complaints.

On the 9th day, the disease deteriorated sharply. Hospitalized. T - 39.8°C, headache, dizziness, vomiting. The patient is retarded, sleepy, disoriented in time and space. Answers on questions in one syllable, quickly depleted. The reaction to pain and sound stimuli is preserved. On examination: nystagmus, strabismus, hand tremor. Finger-nose and knee-heel tests are positive. Kernig's symptoms and Oppenheim's reflex are positive.

The cerebrospinal fluid flows rapidly, cytosis 107 cells, lymphocytes - 88%, neutrophils 12%, protein - 0.45 g/l, glucose - 3.2 mmol/l.

Computed tomography: in the head of the left caudate nucleus revealed a zone of reduced density of 22.6x15.00 mm with fuzzy contours, next to the inner capsule area of 7.0x11.2 mm. The anterior horn of the left lateral ventricle is slightly compromised.

1. Preliminary diagnosis:

- A. Chickenpox, severe course, serous meningitis;
- B. Chickenpox, severe course, meningism;
- C. Chickenpox, severe course, encephalitis;
- D. Chickenpox, severe course, meningoencephalitis;
- E. Chickenpox, severe course, purulent meningitis.

2. Inhibition, drowsiness, disorientation, strabismus indicate the presence of:

- A. General intoxication syndrome;
- B. Meningeal syndrome;
- C. Cerebral syndrome;
- D. Encephalic syndrome;
- E. Encephalitic reaction.

3. The Oppenheim reflex is:

- A. Extension of the big toe sometimes with simultaneous dilation of other toes when carrying out with pressure of a thumb on a front surface of a shin from top to bottom;
- B. The presence of short-term plantar flexion of the toes when tapping on the tips of II - IV toes;
- C. The presence of sucking, swallowing movements of oral automatism with short-term contact with the lips, tongue;
- D. Bending the leg at the knee joint and pulling it to the abdomen while compressing the quadriceps muscle of the other lower limb;
- E. The presence of slow tonic extension of the big toe and fan-shaped dilation of other toes with intense stroke irritation of the outer part of the sole.

4. For the specific diagnosis of neuroinfection caused by chickenpox virus use:

- A. PCR method, detection of DNA from cerebrospinal fluid;
- B. PCR method, detection of RNA from cerebrospinal fluid;
- C. PCR method, detection of DNA of the pathogen from the blood;
- D. PCR method, detection of RNA from the contents of the exanthema;
- E. PCR method, detection of RNA of the pathogen from the blood.

5. Specify the etiotropic drug for the treatment of this patient:

- A. Acyclovir 10 mg/kg intravenously every 8 hours;
- B. Foscarnet 40 mg/kg intravenously every 8 hours;
- C. Cidofovir 5 mg/kg intravenously once a week for 3 weeks;
- D. Valacyclovir per os 1000 mg three times a day;
- E. Ganciclovir 10 mg / kg intravenously every 12 hours.

**Task №5.**

Patient K., 21 years old, became acutely ill: T - 38.5°C, worried about headache, weakness, dry mouth, pain in the right ear, aggravated by chewing, talking. In the area of the corner of the lower jaw on the right is determined by a moderately painful swelling of "doughy" consistency. The skin over the area of

edema is tense, physiological color. Positive Murson's symptom. On the 5th day, the patient's condition improved, T - 36.6°C, swelling decreased.

On the 9th day of the disease there was a sharp deterioration of the patient's condition. T -39.5°C, severe headache. The patient is retarded, sleepy. Answers questions simply, quickly depleted. Reactions to pain and sound stimuli are preserved. Examination revealed strabismus, smoothness of the nasolabial folds, incoordination. Positive finger-nose test. The symptoms of Kernig, Brudzinski and Meitus are negative. Anisoreflexion. The Oppenheim's reflex is positive.

At spinal puncture: cerebrospinal fluid flows in rapid drops, cytos is 4 cells in 1 µl due to lymphocytes, protein 0.55 g/l, protein - 3.2 mmol/l, blood glucose 6 mmol/l.

At a computer tomography in a brainstem is the zone of the lowered density of 10,1x8,3 mm without clear borders is revealed.

1. Preliminary diagnosis:

- A. Mumps, severe course, serous meningitis;
- B. Mumps, severe course, meningism;
- C. Mumps, severe course, encephalitis;
- D. Mumps, severe course, meningoencephalitis;
- E. Mumps, severe course, purulent meningitis.

2. The specify changes in the cerebrospinal fluid in this patient:

- A. Lymphocytic pleiocytosis, normal protein and glucose levels;
- B. Lymphocytic pleiocytosis, increase in protein content against the background of normal glucose;
- C. All indicators of cerebrospinal fluid are normal;
- D. Normal cytos and glucose levels and increased protein content;
- E. Lymphocytic pleiocytosis, increase in glucose on background of normal protein.

3. Meitus symptom is:

- A. The inability of the patient to sit straight with legs outstretched;
- B. The inability of the patient to sit down independently with outstretched and fixed knees;

- C. The inability of the patient to sit in bed only with his hands behind his back;
  - D. Bending the leg at the knee joint and pulling it to the abdomen while compressing the quadriceps muscle of the other lower limb;
  - E. Impossibility of the patient to touch lips to a knee even at the lower extremities bent in hip joints.
4. For the diagnosis of neuroinfection caused by mumps virus use:
- A. Use a lumbar puncture, specific diagnosis is not performed in the presence of a typical clinic;
  - B. MRI of the cerebrum, lumbar puncture only for indications;
  - C. PCR method, detection of DNA of the pathogen from the blood;
  - D. PCR method, detection of DNA of the pathogen from cerebrospinal fluid;
  - E. PCR method, detection of DNA of the pathogen from saliva.
5. The pathogenetic drug that should be prescribed in this case as early as possible:
- A. Acyclovir 10 mg/kg intravenously every 8 hours;
  - B. Glucocorticosteroids 5 mg/kg of prednisolone;
  - C. Intravenous immunoglobulin 0.4 - 0.8 g/day;
  - D. Mannitol 1 g/kg intravenously, drip;
  - E. Furosemide 2-3 mg/kg intravenously.

#### **Task 6.**

Patient A., 19 years old, became acutely ill: T - 38.0° C, the strongest prickly pains in the lower parts of the chest, exacerbated by movement in bed, cough. Myalgia attacks lasted for several minutes and were repeated several times during the day. During seizures, breathing is shallow. In the period between attacks, the muscles are painless on palpation. Vesicular respiration, no wheezing. The attacks recurred for 4 days.

On the 6th day of the disease the patient's condition deteriorated. Hospitalized. T - 39.5°C, headache, weakness, sleep disturbances, loss of appetite, vomiting, not related to food intake. Occipital muscle rigidity, a positive Kernig's symptom.

At a spinal puncture: cerebrospinal fluid flows under pressure, a pleiocytosis of 350 cells in 1  $\mu$ l., lymphocytes 48%, neutrophils 52%, protein - 0.3 g/l, glucose - 3.0 mmol/l. In the general analysis of blood: leukocytes  $5,0 \times 10^9/l$ , rod nuclear 10%, segmental 48%, lymphocytes 33%, monocytes 9%. ESR - 8 mm per hour. When performing a lumbar puncture the next day: the cerebrospinal fluid flows under pressure, cytolysis 345 cells in 1  $\mu$ l., lymphocytes 75%, neutrophils 25%, protein - 0.3 g/l, glucose - 3.0 mmol/l.

1. Preliminary diagnosis:

- A. Enterovirus infection, epidemic myalgia, serous meningitis;
- B. Enterovirus infection, community-acquired pneumonia, serous meningitis;
- C. Enterovirus infection, intercostal neuralgia, serous meningitis;
- D. Enterovirus infection, epidemic myalgia, purulent meningitis;
- E. Enterovirus infection, epidemic myalgia, encephalitis.

2. Indicate the changes in the cerebrospinal fluid that are detected in the patient at the first lumbar puncture and characteristic of enterovirus neuroinfection in the first day of the disease:

- A. Lymphocytic pleiocytosis, normal protein and glucose levels;
- B. Mixed pleiocytosis, normal protein and glucose levels;
- C. Neutrophilic pleiocytosis, normal protein and glucose levels;
- D. Neutrophilic pleiocytosis, increased protein content, normal glucose content;
- E. Neutrophilic pleiocytosis, increase in protein content, increase in glucose content.

3. The symptom of occipital muscle rigidity is:

- A. Bending of the lower extremities in the knee joint and pulling them to the anterior abdominal wall when pressing the edge of the palm on the pubic symphysis;
- B. Impossibility to reach the edge of the chin to the edge of the sternum with passive bending of the neck;
- C. Flexion of the lower limb in the knee joint and pulling it to the abdomen when stretching the other limb in the knee joint;



- D. Impossibility to unbend the lower limb in the knee joint, with preliminary bending of the limb in the knee and hip joint at an angle of 90 °;
  - E. Bending the leg at the knee joint and pulling it to the abdomen while compressing the quadriceps muscle of the other lower limb;
4. The "gold" standard for the diagnosis of enterovirus neuroinfection is:
- A. PCR method, detection of RNA of the pathogen from blood;
  - B. PCR method, detection of RNA of the pathogen from saliva;
  - C. PCR method, detection of DNA of the pathogen from the blood;
  - D. PCR method, detection of DNA of the pathogen from cerebrospinal fluid;
  - E. PCR method, detection of RNA of the pathogen from cerebrospinal fluid.
5. The etiotropic drug for the treatment of enterovirus infection:
- A. Acyclovir;
  - B. Oseltamivir;
  - S. Nivirin;
  - D. Amizon;
  - E. Pathogenetic therapy, no etiotropic therapy.

### **Task 7.**

Ivanov M., 50 years old, considers himself ill since 01.02., When there was weakness, irritability, decreased appetite, T - 37.2°C. He continued to go to work. 06.02. feeling worse: T-38.9°C, headache, dizziness, the next day the headache worsened, vomiting joined.

Hospitalized. The patient is pale, reluctant to come into contact. Responds slowly, remembers current events poorly. On examination: ptosis, strabismus, smoothness of the nasolabial folds. Positive finger-nose test, hand tremor. General hyperesthesia. Positive symptom of Kernig, pronounced stiffness of the occipital muscles. Weakly positive pathological reflexes Babinsky and Oppenheim food reflex.

A spinal puncture was performed. Cerebral fluid flows under pressure, transparent, cytolysis of 105 cells in 1 µl, of which 82% - lymphocytes, 18%

neutrophils, protein 2.5 g / l, glucose - 1.5 mmol / l. Reaction of Pandy (+++), Nonna - Apelta (++++).

1. Preliminary diagnosis:

- A. Tuberculous basal meningoencephalitis;
- B. Tuberculous encephalitis;
- C. Tuberculous serous meningitis;
- D. Tuberculosis, meningism;
- E. Tuberculous purulent meningitis.

2. Specify the changes in the cerebrospinal fluid that are characteristic of CNS damage in tuberculosis:

- A. Lymphocytic pleiocytosis with high protein and glucose;
- B. Lymphocytic pleiocytosis with low protein and glucose;
- C. Lymphocytic pleiocytosis, increased protein content, normal glucose content;
- D. Lymphocytic pleiocytosis, glucose content is sharply reduced, protein content is normal;
- E. Lymphocytic pleiocytosis, glucose content is sharply reduced, protein content is increased.

3. Which cranial nerves are most often affected by tuberculous lesions of the CNS:

- A. Bulbar group of cranial nerves;
- B. N. vagus;
- S. Oculomotor group of cranial nerves;
- D. Facial nerve;
- E. Olfactory nerve.

4. The "gold" standard for the diagnosis of tuberculous lesions of the CNS:

- A. Diaskintest;
- B. PCR method, isolation of pathogen RNA from cerebrospinal fluid;
- C. The presence of a fibrin film on the surface of the cerebrospinal fluid;
- D. PCR method, detection of pathogen DNA from cerebrospinal fluid;
- E. PCR method, detection of RNA from sputum and cerebrospinal fluid.

5. Specify etiotropic therapy for tuberculous lesions of the CNS:

- A. Vancomycin + ceftriaxone;
- B. Ceftriaxone + amikacin;
- C. Penicillin + amikacin;
- D. Vancomycin + levofloxacin;
- E. Rifampicin + isoniazid + pyrazinamide.

### **Task 8**

Patient M., 32 years old, rodent control. Ill acutely: there was a pronounced weakness, headache, sharp pain in the calf muscles, due to which it was difficult to move around the room. T - 38.5°C. Took citramon, analgin, but no improvement was observed. He went to the doctor on the fourth day of illness. Hospitalized. On examination: the face is hyperemic, swollen. Sclera jaundice. On the lips and wings of the nose - herpetic rash. Vesicular respiration, no wheezing. Heart tones are muffled, pulse 85 beats per minute, blood pressure = 100/60 mm Hg. The abdomen is soft and painless. The liver along the mid-clavicular line protrudes from the edge of the costal arch by 1.5 cm, moderately painful. Diuresis is reduced. On day 6 of the disease, T - 39.8 39C deteriorated. The headache increased, vomiting and general hyperesthesia appeared. Positive meningeal signs: stiffness of the occipital muscles, symptoms of Kernig, Matus, Bekhterev, weakly positive symptom of Pasternatsky.

General blood test: erythrocytes  $2.9 \times 10^{12} / l$ , leukocytes  $20.2 \times 10^9 / l$ , rod-shaped - 18%, segmental - 61%, lymphocytes - 12%, monocytes - 9%, ESR - 45 mm / h. A spinal puncture was performed. The cerebrospinal fluid flows under pressure, transparent, cytosis of 110 cells in 1  $\mu$ l, lymphocytes - 56%, neutrophils - 44%, protein - 0.9 g / l, glucose - 2.5 mmol / l.

1. Preliminary diagnosis.

- A. Leptospirosis, serous meningitis;
- B. Leptospirosis, purulent meningitis;
- C. Leptospirosis, meningoencephalitis;
- D. Leptospirosis, meningism;
- E. Leptospirosis, encephalitis.

2. Specify the normal values of protein content in the cerebrospinal fluid:

- A. 1.0-1.5 g / l;
- B. up to 0.15 g / l;
- C. ½ from the content of total protein in the blood;
- D. 0.15-0.33 g / l;
- E. Normally, protein should not be contained in the cerebrospinal fluid.

3. Symptom Bekhtereva is:

- A. Impossibility to sit independently with unbent and fixed knees;
- B. Impossibility to sit straight with legs outstretched;
- C. Impossibility to sit in bed only leaning his hands behind his back;
- D. Increased cephalgia and the appearance of a "painful grimace" when tapping the patient on the zygomatic arch;
- E. Impossibility to touch the knees to the knee even with the lower extremities bent at the hip joints.

4. The "gold" standard for the diagnosis of leptospirosis is:

- A. Agglutination reaction, diagnostic titer 1: 200;
- B. Increase in antibody titer 4 or more times in paired sera at RGGGA;
- C. Detection of IgM in ELISA;
- D. Increase in antibody titer 4 or more times in paired sera with PMA;
- E. Immunofluorescence reaction, diagnostic titer 1: 20-1: 40.

5. Specify etiotropic therapy for leptospirosis of the CNS:

- A. Penicillin sodium salt 100 thousand IU / kg;
- B. Penicillin potassium salt 300 thousand IU / kg;
- C. Azithromycin 10 mg / kg;
- D. Chloramphenicol succinate 100 mg / kg;
- E. Penicillin sodium 300 thousand IU / kg.

### **Task 9**

Patient K., 27 years old, considers himself ill since April 3, when at 5 o'clock in the morning there was chills, severe headache in the frontotemporal region, pain in the eyeballs, vomiting, which does not bring relief. In the evening

of the same day he was hospitalized. Sick in consciousness, but depressed, experiencing feelings of anxiety. Answers questions slowly, not always correctly. Poorly oriented in time. Hyperesthesia is pronounced. The skin is pale, on the skin of the forearms and legs hemorrhagic rash. Elements of the rash of different sizes in the form of irregularly shaped stars. Vesicular respiration, no wheezing. Heart tones are muffled, pulse 110 beats in 1, blood pressure = 80/70 mm Hg. The liver and spleen are not palpable. Expressed rigidity of the occipital muscles. Positive symptoms of Kernig, Brudzinski lower, Bekhterev.

In the general analysis of blood: leukocytes  $21 \times 10^9 / l$ , rod-nuclear - 27%, segment-nuclear -62%, lymphocytes - 9%, monocytes -2%. ESR - 45 mm / year. A spinal puncture was performed. The cerebrospinal fluid flows under high pressure, turbid, cytos 1200 cells in 1  $\mu l$ , 79% - neutrophils, 21% - lymphocytes, protein -1 g / l, glucose - 2.2 mmol / l. Pandi reaction ++, Nonny-Apelta reaction +++.

1. Preliminary diagnosis.

- A. Meningococcal infection, generalized, mixed form (meningococemia + meningitis), ITS;
- B. Meningococcal infection, generalized, mixed form (meningococemia + meningitis), acute adrenal insufficiency
- C. Meningococcal infection, generalized, mixed form (meningococemia + meningitis), brain abscess;
- D. Meningococcal infection, generalized, mixed form (meningococemia + meningitis), edema-swelling of the brain
- E. Meningococcal infection, generalized form, purulent meningitis.

2. CNS lesions of meningococcal etiology are characterized by:

- A. Neutrophilic pleocytosis, increased glucose and protein content;
- B. Neutrophilic pleocytosis, normal levels of protein and glucose;
- C. Neutrophilic pleocytosis, decreased glucose and protein content;
- D. Neutrophilic pleocytosis, increased glucose and decreased protein;
- E. Neutrophilic pleocytosis, decreased glucose and increased protein.

3. Specify normal indicators of cytos in cerebrospinal fluid:

- A. up to 10 cells due to neutrophils;
  - B. up to 100 cells due to lymphocytes;
  - C. no more than 3 cells, lymphocytes;
  - D. up to 10 cells due to lymphocytes;
  - E. up to 100 cells due to neutrophils.
4. Specify the features of the bacteriological method of research in meningococcal infection in this patient:
- A. material blood, medium - bile broth, medium temperature 37°C;
  - B. material cerebrospinal fluid, and blood, medium - blood agar, medium temperature 37°C;
  - C. material cerebrospinal fluid, medium - blood agar, medium temperature 37°C;
  - D. material cerebrospinal fluid, blood, and nasopharyngeal secretions, medium - blood agar, medium temperature 37°C;
  - E. material cerebrospinal fluid, blood, and nasopharyngeal secretions, medium - bile broth, medium temperature 37°C.
5. Specify etiotropic therapy for this patient:
- A. Azithromycin 10 mg / kg;
  - B. Amikacin 15 mg / kg;
  - C. Levofloxacin 1 g / day;
  - D. Chloramphenicol succinate 100 mg / kg;
  - E. Vancomycin 2 g / day.

### **Task 10**

Patient K., 65 years old, during the last two weeks noted purulent discharge from the right ear, did not seek medical help, treated himself. March 2: T - 39.3°C, complains of a sharp headache, dizziness, vomiting. At hospitalization - retarded, answers questions briefly, slowly, disoriented in time and place. On examination: pale, cyanosis of the lips. Nystagmus, strabismus, hand tremor, positive finger-nose test, smoothed nasolabial fold on the left. Positive meningeal symptoms (rigidity of the occipital muscles, Kernig, upper Brudzinski, Meitus, Bekhterev) and a positive Babinsky reflex.

During the last 2 years he was repeatedly treated for chronic purulent otitis. In the general analysis of blood: erythrocytes  $3,4 \times 10^{12} / l$ , leukocytes  $18,0 \times 10^9 / l$ , eosinophils - 0, basophils - 0, myelocytes - 5%, rod-nuclear -24%, segment-nuclear -51%, lymphocytes -12%, monocytes -8 %, ESR -42 mm / year.

The cerebrospinal fluid is cloudy, cytositis of 3000 cells in 1  $\mu l$ , 90% - neutrophils, 10% - lymphocytes, protein - 3 g / l, glucose - 1.9 mmol / l, Pandy reaction +++, Nonny-Apelt reaction (++++ +).

1. Preliminary diagnosis.

- A. Pneumococcal secondary meningitis;
- B. Pneumococcal secondary purulent meningoencephalitis;
- C. Pneumococcal primary purulent meningitis;
- D. Pneumococcal primary purulent meningoencephalitis;
- E. Pneumococcal infection, severe. Sepsis. Meningism.

2. Assign the fastest method of specific diagnosis of pneumococcal infection in this case:

- A. PCR, detection of pneumococcal DNA from cerebrospinal fluid;
- B. Bacteriological method, detection of pneumococcus from cerebrospinal fluid;
- C. PCR, detection of pneumococcus from the blood;
- D. Bacteriological method, detection of pneumococcus from the blood;
- E. PCR, detection of pneumococcus from ear discharge.

3. Specify the duration of etiotropic therapy for pneumococcal CNS lesions:

- A. 10 days;
- B. 7 days;
- C. 14-21 days;
- D. the duration of etiotropic therapy depends on the regression of clinical symptoms;
- E. up to 7 days of normal body temperature.

4. The duration of antibiotic therapy for pneumococcal infection is due to:

- A. High frequency of recurrence and abscessing;

- B. Pneumococcus quickly becomes resistant to antibacterial drugs in the human body;
  - C. Prolonged antibiotic therapy prevents atrophic changes in the brain;
  - D. Prolonged antibiotic therapy prevents complications from the cardiovascular system;
  - E. All of the above is true.
5. Specify the drug of choice of etiologic therapy for this patient:
- A. Chloramphenicol succinate 100 mg / kg;
  - B. Amikacin 15 mg / kg;
  - C. Levofloxacin 1 g / day;
  - D. Vancomycin 2 g / day;
  - E. Ampicillin 3 g every 4 times.

### **Task 11**

Patient B, 28 years old. For two weeks on the skin of the forearm and chest noticed single boils. On October 5, she noticed a carbuncle on her right cheek and tried to remove the pus on her own. On October 7, the condition deteriorated sharply: T-39°C, severe headache in the fronto-temporal region, severe weakness, dizziness, muscle and joint pain, nausea, vomiting, not associated with food intake. Hospitalized. The patient is retarded. Examination revealed pale, cyanosis of the lips and tip of the nose, 2 carbuncles were found on the skin of the chest, boils on the face, and a hemorrhagic rash on the fingers. Hypersensitivity to bright light. Vesicular respiration, no wheezing. Heart tones are muffled, pulse 110 beats / min., Blood pressure = 100/60 mm Hg. The abdomen is soft, painless. Liver +2 cm of moderate density, spleen + 1 cm. Expressed rigidity of the occipital muscles, positive symptoms of Kernig, Bekhterev.

A spinal puncture was performed. The cerebrospinal fluid flows under pressure, turbid, cytosis of 1860 cells in 1 µl, neutrophils 85%, lymphocytes 15%, protein - 1.2 g / l, glucose - 2.3 mmol / l, Pandy and Nonni-Apelta reaction are positive (++ +). In the general analysis of blood: erythrocytes -  $2,4 \times 10^{12}$  / l,



leukocytes -  $18,2 \times 10^9 / l$ , rod nuclear - 24%, segmental - 60%, lymphocytes - 10%, monocytes - 6%, ESR - 48 mm / h.

Computer tomography performed on October 14 in the midbrain revealed the formation of a round shape with a zone of low density inside, the contours of the high-density capsule.

1. Preliminary diagnosis.

- A. Staphylococcal secondary meningitis;
- B. Staphylococcal secondary purulent meningoencephalitis;
- C. Staphylococcal primary purulent meningitis;
- D. Staphylococcal primary purulent meningoencephalitis;
- E. Staphylococcal infection: carbuncle of the right cheek, meningism.

2. What complication occurred in the patient:

- A. Arachnoiditis
- B. Brain abscess
- S. Epidendimitis
- D. Edema-swelling of the brain
- E. Acute cerebrovascular accident of the ischemic type

3. Specify the criterion for withdrawal of antibiotic therapy for purulent neuroinfections:

- A. Normalization of fever;
- B. Regression of cerebral and meningeal symptoms;
- C. Lymphocytic pleiocytosis, cytosis of less than 32 cells during control lumbar puncture, regression of the clinic;
- D. Lymphocytic pleiocytosis in any cytosis during a control lumbar puncture;
- E. Normalization of indicators of the general analysis of blood.

4. What method of specific diagnosis should be used to establish the etiology of CNS damage in this case:

- A. Inoculation of cerebrospinal fluid on meat-peptone agar;
- B. Blood culture on meat-peptone agar;
- C. Inoculation of cerebrospinal fluid in bile broth;

- D. Blood culture on blood agar;
  - E. Cerebrospinal fluid culture on blood agar.
5. Specify the drug of choice of etiotropic therapy for this patient:
- A. Ceftriaxone;
  - B. Penicillin;
  - C. Levofloxacin;
  - D. Ceftriaxone + oxacillin;
  - E. Azithromycin.

### **Task 12**

Patient D, 19 years old, student, acutely ill, body temperature 38.1 ° C, headache in the frontotemporal region, which is not relieved by analgesics, weakness, loss of appetite. On the 2nd day of the disease on the background of hyperthermia increased headache, nausea, vomiting, which does not bring relief, photophobia, pain in the eyeballs. On objective examination, the SMP doctor found positive meningeal symptoms: stiff neck muscles, Kernig's symptom.

At hospitalization the condition is severe. Body temperature 40.2 ° C, level of consciousness - deep stupor. Answers questions after a long pause, quickly depleted. Disoriented in personality, space, time. Meningeal symptoms are pronounced. Tendon reflexes are preserved. In the waiting room there was an episode of tonic-clonic seizures.

On objective examination: skin and visible mucous membranes of physiological color, clean. The mucous membrane of the oropharynx is pink, there are no catarrhal phenomena. Breathing is vesicular, is carried out evenly, there is no wheezing. NPV - 22 / minute. The heart is rhythmic, the tones are muted. Heart rate 110 per minute. AT 90/60 mm.pt.ct. The abdomen is soft, painless, the liver and spleen are not palpable. Physiological mandrels are normal.

From the epidemiological history it became known that 3 days before the disease was symptomatically treated for nasopharyngitis.

In general analysis of blood leukocytes  $20 \times 10^9 / l$ , rod-shaped neutrophils - 15%, segmental neutrophils - 70%, lymphocytes - 15%. The study of cerebrospinal

fluid revealed cytosis of 900 cells, neutrophils - 96%, protein - 2.36 g / l, glucose - 1.8 mmol / l, chlorides - 117 mmol / l. Gram-negative diplococci were detected by cerebrospinal fluid bacterioscopy. Blood glucose - 5.0 mmol / liter. Blood osmolarity 300 mosm / l.

1. Preliminary diagnosis.

- A. Meningococcal infection, generalized, mixed form;
- B. Meningococcal infection, generalized form, meningoencephalitis;
- C. Meningococcal infection, generalized form, meningococemia;
- D. Meningococcal infection, localized form, acute nasopharyngitis, meningism;
- E. Meningococcal infection, generalized form, purulent meningitis.

2. What complication did the patient have:

- A. ITS;
- B. Brain abscess;
- C. Epilepsy;
- D. Edema-swelling of the brain;
- E. Subarachnoid hemorrhage.

3. The drug of choice in dehydration therapy in this case are:

- A. Furosemide;
- B. Hypotonic sodium chloride solution;
- C. Hypertonic sodium chloride solution;
- D. Mannitol;
- E. Albumin.

4. Specify measures for contact persons:

- A. Observation for 10 days, a single bacteriological examination of nasopharyngeal mucus;
- B. Observation for 10 days, a single bacteriological blood test;
- C. Observation for 5 days, a single bacteriological examination of nasopharyngeal mucus;
- D. Observation for 5 days, a single bacteriological blood test;
- E. No contact measures are taken.

5. Specify the drug of choice of etiologic therapy for this patient:

A. Amikacin;

B. Penicillin;

C. Levofloxacin;

D. Oxacillin;

E. Azithromycin.

## TESTS

1. Everything applies to meningeal syndrome, with the exception of: A - hyperesthesia to sound and light stimuli; B - headache; C - vomiting; D \* - a positive symptom of Padalka; E - stiff neck.

2. When trying to tilt the head of a patient in a supine position, it is impossible to bring the chin to the sternum. This is a positive symptom: A - Oppenheim; B - upper Brudzinsky; C - Kernig; D \* - stiff neck; E - Matus.

3. The impossibility of passive extension of the patient's legs in the knee joint, previously bent at right angles in the knee and hip joints. This is a positive symptom: A \* - Kernig; B - lower Brudzinsky; C - Matus; D - Fanconi; E - Bekhterev.

4. Involuntary bending of the legs in the knee joints in response to an attempt to bring the head to the chest in the supine position. This is a positive symptom: A - Kernig; B \* - upper Brudzinsky; C - Rossolimo; D - Matus; E - Fanconi.

5. When trying to straighten a leg in the knee joint, the other leg bends at the knee joint. This is a positive symptom: A - Kernig; B - upper Brudzinsky; C \* - lower Brudzinsky; D - Oppenheim; E - Fanconi.

6. The inability to sit on their own with straight and fixed knees. This is a positive symptom: A - Kernig; B - upper Brudzinsky; C - lower Brudzinsky; D - Oppenheim; E \* - Fanconi.

7. A patient with meningitis can only sit in bed with his hands behind his back. This is a positive symptom: A - Kernig; B \* - "tripod"; C - Brudzinskaya pubic; D - Bekhterev; E - Oppenheim.

8. With percussion of the zygomatic arch, the headache intensifies and a painful grimace arises involuntarily on the corresponding half of the face. This is a positive symptom: A - Kernig; B - lower Brudzinsky; C - Matus; D - Fanconi; E \* - Bekhterev

9. With intense stroke irritation of the sole appears extension of the thumb and fan-like dilution of the remaining toes. This is a positive pathological reflex. A - Babinsky; B - Brudzinsky; C - Oppenheim; D - Oppenheim food reflex; E - Rossolimo.

10. Meningeal symptoms include everything except: A - Kerning; B - Brudzinsky; C \* - Babinsky; D - Fanconi; E - Matus.

11. Pathological reflexes include: A - Babinsky; B - Oppenheim; C - Oppenheim food reflex; D - Rossolimo; E - that's right.

12. Positive meningeal signs can be detected with: A meningism; B - meningitis; C - subarachnoid hemorrhage; D - carbon monoxide poisoning; E \* - that's right.

13. Liquor flows under pressure, transparent, cytosis of 6 cells in 1  $\mu$ l due to lymphocytes, protein 0.33 g / l. Sugar 3.0 mmol / L. Pandy reaction (-). This cerebrospinal fluid is characteristic for: A \* - meningism; B - serous meningitis; C - purulent meningitis; D - subarachnoid hemorrhage; E - that's right.

14. Liquor flows under pressure, transparent, cytosis of 120 cells. in 1  $\mu$ l, lymphocytes 83%, neutrophils 17%, protein 0.4 g / l, sugar 3.0 mmol / l. This cerebrospinal fluid is characteristic for: A - meningism; B \* - serous meningitis; C - purulent meningitis; D - subarachnoid hemorrhage; E - normal cerebrospinal fluid.

15. Liquor flows under pressure, turbid, cytosis of 980 cells. in 1  $\mu$ l, lymphocytes 15%, neutrophils 85%, protein 1.2 g / l, sugar 2.1 mmol / l. This cerebrospinal fluid is characteristic for: A - meningism; B - serous meningitis; C \* - purulent meningitis; D - subarachnoid hemorrhage; E - normal cerebrospinal fluid.

16. The cerebrospinal fluid flows out under pressure, when defending xanthochromic, cytosis of 70 cells. in 1  $\mu$ l., red and fresh red blood cells, neutrophils, lymphocytes. Protein 0.98 g / l, sugar 3 mmol / l. This cerebrospinal fluid is characteristic for: A - meningism; B - serous meningitis; C - purulent meningitis; D \* - subarachnoid hemorrhage; E - normal cerebrospinal fluid.

17. Meningism can be observed in severe cases: A typhoid; B - shigellosis; C - influenza; D - typhus; E \* all right.

18. Serous bacterial meningitis includes: A \* - tuberculosis; B - meningococcal; C - pneumococcal; D - staphylococcal; E - that's right.

19. Serous viral meningitis includes all but: A - herpetic; B - chickenpox; C - mumps; D \* - tuberculosis; E - enterovirus.

20. Purulent meningitis includes: A - herpetic; B - enterovirus; C - tuberculosis; D \* - meningococcal; E - that's right.

21. With meningoencephalitis as a result of CNS depression, the following can be observed: A - lethargy, drowsiness; B - disorientation in time and place; C - psychomotor agitation; D - emotional instability, inappropriate behavior; E \* - that's right.

22. The patient, having averted his hand, is offered to slowly get his index finger into the tip of the nose. He carries his hand beyond the goal. This is a positive symptom: A - Matus; B - Oppenheim; C \* - test for the detection of dynamic ataxia; D - test for the detection of static ataxia; E - that's right.

23. Ptosis, anisocoria, divergent strabismus, impaired convergence and accommodation, a weak reaction to light are characteristic of damage: A \* - oculomotor nerve; B - abduction nerve; C - facial nerve; D - the hyoid nerve; E - optic nerve.

24. The omission of the angle of the mouth, the smoothness of the nasolabial folds and the intensification of the asymmetry of the face when teeth are bared, the palpebral fissure is open, the eyebrow is lowered, motionless. This symptomatology is characteristic of a lesion: A - oculomotor nerve; B - abduction nerve; C \* - facial nerve; D - the hyoid nerve; E - optic nerve.

25. Converging strabismus, diplopia are characteristic of a lesion: A - oculomotor nerve; B \* - abduction nerve; C - facial nerve; D - the hyoid nerve; E - optic nerve.

26. With meningoencephalitis focal symptoms may occur: A - severe anisoreflexia of tendon reflexes; B - spastic hemi- and paraparesis; C - coordinating violations; D - positive pathological reflexes; E \* - all of the above is true.

27. Computed tomography in the brain stem revealed the formation of a round shape with a zone of low density inside, the contours of the capsule of high density. This is characteristic of: A - encephalitis, B \* - abscess of the brain; C - tumors; D - meningitis; E - subarachnoid hemorrhage.

28. When computed tomography in the brain stem revealed a zone of reduced density of 15.1 x 17.3 mm without clear boundaries. This is characteristic of: A \* - encephalitis, B-brain abscess; C - tumors; D - meningitis; E - subarachnoid hemorrhage.

29. Everyone applies to bactericidal antibiotics, with the exception of: A - penicillin; B \* - chloramphenicol; C - cephalosporins; D is rifampicin; E - gentamicin.

30. With purulent meningitis, when choosing an antibiotic, it is necessary to take into account: A - the ability to penetrate the blood-brain barrier; B - minimal toxicity to the central nervous system; C - pathogen resistance to this antibiotic; D - the presence of allergies to the selected antibiotic;

E \* - that's right.

31. Everything belongs to crystalloid solutions, with the exception of: A \* - albumin; B-lactosalts; C - 5% glucose solution; D - Ringer's solution; E - glucose-potassium mixture.

32. Colloidal solutions include: A \* - albumin; B - lactosol; C - 5% glucose solution; D - Ringer's solution; E - glucose-potassium mixture.

33. Everything belongs to diuretics, with the exception of: A lasix; B - mannitol; C is diacarb; D - furosemide; E \* -diazepam.

34. In the period of early convalescence of purulent meningoencephalitis after discontinuation of antibiotics, all preparations are indicated, except:

A \* - azeltamivir; B - pentoxifylline; C-piracetam; D - nootropil; E - cerebrolysin.

35. Patient A. fell ill acutely: T - 39.5 ° C, headache, weakness. Sore throat, dry cough, aching pain behind the sternum. The mucous membrane of the granular pharynx. Positive symptom of Kernig. Liquor flows under pressure, transparent, cirrhosis 4 cells. in 1 µl, lymphocytes, protein 0.3 g / l, sugar 3.1 mmol / l: A - meningococcal meningitis; B \* - flu, meningism; C - flu, serous meningitis; D - enteroviral serous meningitis; E - tuberculous meningitis.

36. Patient V., became acutely ill: T-38.0 ° C, runny nose, sore throat, pain and sensation of “sand” in the eyes. The conjunctiva is swollen, hyperemic, covered with



a film that is easily removed. Stiff neck. Liquor flows out under pressure, transparent, cirrhosis 7 cells. in 1  $\mu$ l., lymphocytic, protein 0.28 g / l, sugar 3.0 mmol / l: A - flu; B - meningococcal meningitis; C \* - adenovirus infection, meningism; D - enteroviral meningitis; E - herpetic meningitis.

37. Patient K., hospitalized unconscious. Ill on the eve of: T - 40 ° C, severe headache, vomiting, photophobia. On examination, stiff neck, symptom of Kernig. What kind of research should be done first to make a diagnosis?: A - electroencephalography; B - computed tomography; C \* - lumbar puncture; D - blood glucose; E - creatinine, residual nitrogen, urea.

38. Herpes simplex viruses are tropic to: A - skin integument; B - mucous membranes; C - neurocytes; D - to the ganglia of the trigeminal nerve; E \* - that's right.

39. Herpes simplex viruses can cause the development of: A - keratoiridocyclitis; B - optic neuritis; C - encephalitis; D - hepatitis; E \* - that's right.

40. Herpes simplex viruses (HHV1 and HHV2) relate to: A - herpesviruses; B - DNA-containing; C - capable of persistence, which causes the presence of prolonged latency; D - has a cytopathic effect on infected cells, which manifests itself in the formation of multinucleated cells; E \* - that's right.

41. Patient A, 18 years old, complains of weakness, T 38.5 ° C, headache, itching, burning and rashes on the external genitalia. Rash in the form of papules and vesicles. Inguinal lymphadenitis. Positive meningeal signs. Liquor flows out under pressure, transparent, pleocytosis 170 cells in 1  $\mu$ l., lymphocytes - 80%, neutrophils - 20%, protein 0.6 g / l, sugar - 3 mmol / l: A - mumps meningitis; B \* - herpetic meningitis; C - enterovirus infection, meningism; D - chickenpox meningitis; E - staphylococcal meningitis.

42. The main method for confirming herpetic meningitis is: A - the clinical picture; B - the nature of the cerebrospinal fluid; C - high titers of antibodies (ELISA); D \* - detection of cerebrospinal fluid DNA virus in PCR; E - that's right.

43. The etiotropic drug in the treatment of patients with herpetic meningoencephalitis is: A - lamivudine; B \* - acyclovir; C is remantadine; D - oseltamivir; E - all equally effective.

44. Chickenpox meningitis causes: A - type 1 herpes virus; B -  $\alpha$ -herpesvirus type 2; C \* -  $\alpha$ -herpesvirus type 3; D - Epstein-Barr virus; E - cytomegalovirus.

45. The patient within 4 days T 39 -39,5 ° C, headache. On the skin of the scalp and trunk against an unchanged background, elements of a rash: spots, papules, vesicles, crusts. Inhibited, horizontal nystagmus, tremor of the hands, left-sided hemoparesis. Stiff neck. Preliminary diagnosis: A - herpetic meningitis; B - cytomegalovirus meningoencephalitis; C - chickenpox, meningism; D - chickenpox meningitis; E \* - chickenpox meningoencephalitis.

46. In the hemogram with chickenpox meningitis, it is more often found: A \* - leukopenia, lymphomonocytosis; B - leukopenia, neutrophilia; C - leukocytosis with a shift of the formula to the left; D - anemia, reticulocytosis; E - ESR - 35 mm / hour.

47. The etiotropic drug in the treatment of patients with chickenpox meningoencephalitis is: A \* - acyclovir; B - oseltamivir; C is rheopheron; D - zanamivir; E is lamivudine.

48. Enterovirus meningitis is caused by enteroviruses: A - Koksaki A type 4; B - Koksaki B type 5; C - ECHO type 4; D - ECHO type 6; E \* - that's right.

49. Patient A., within 4 days T 38.5 ° C, headache, vomiting. Stiff neck, positive symptoms of Matus, Ankylosing spondylitis. A history of contact with patients with epidemic myalgia, herpetic angina. The cerebrospinal fluid flows out under pressure, transparent, cytosis of 200 cells per  $\mu$ l, lymphocytes 65%, protein 0.35 g / l, sugar 3.1 mmol / l: A - herpetic meningitis; B - herpetic meningoencephalitis; C \* - enteroviral meningitis; D - meningococcal meningitis; E - hippus, meningism.

50. At what serous viral meningitis on the first day of illness in a cerebrospinal fluid neutrophils prevail: A \* - enterovirus; B - tuberculosis; C - mumps; D - chickenpox; E - for all the same.

51. The main method for confirming enteroviral meningitis is: A - the clinical picture; B - the nature of the cerebrospinal fluid; C \* - detection of cerebrospinal fluid RNA in PCR; D - general blood test; E - all of the above.

52. The main drugs in the treatment of enteroviral meningitis are: A - oseltamivir; B - acyclovir; C is lamivudine; D \* - pathogenetic drugs; E - foscarnet.

53. Patient K., became acutely ill: T 39 ° C, headache, vomiting, there were prolonged (30–40 minutes) attacks of severe pain in the muscles of the chest, repeated several times during the day. In the period between attacks, the muscles are painless on palpation. A positive symptom of Kernig. On the same day, a puncture was performed. Liquor transparent, cytosis of 827 cells. At 1 µl, 72% neutrophil, protein 0.6 g / L. sugar - 3.2 mmol / l.: A \* - enteroviral meningitis; B - tuberculosis; C - meningococcal; D - pneumococcal; E - staphylococcal.

54. A patient with a clinic of submaxylitis and pancreatitis revealed positive meningeal signs. With spinal puncture, cerebrospinal fluid flows under pressure, transparent, cytosis of 250 cells. in 1 µl, lymphocytes 90%, protein - 0.85g / l, sugar - 3.0 mmol / l. A \* - mumps meningitis, B - hippus, meningism; C - herpetic meningitis; D - mumps meningoencephalitis; E - meningococcal meningitis.

55. The diagnosis of mumps meningitis is confirmed by the isolation of the pathogen from: A - blood; B \* - cerebrospinal fluid; C - urine; D - secretion of the salivary glands; E - that's right.

56. In the hemogram with parotitis meningitis, they detect: A \* - leukopenia, lymphomonocytosis; B - leukopenia, neutrophilia; C - leukocytosis with a shift of the formula to the left; D - anemia, reticulocytosis; E - ESR - 35 mm / hour.

57. For the treatment of mumps meningitis, apply: A - ceftiaxone; B - acyclovir; C - oseltamivir; D - ganciclovir; E \* - pathogenetic agents.

58. In cerebrospinal fluid - pleocytosis of 400 cells. in 1 µl, 82% - lymphocytes, protein 2.5 g / l, sugar - 1.5 mmol / l. This is characteristic of meningitis: A \* - tuberculosis; B - meningococcal; C - mumps; D - enterovirus; E - Meningism.

59. Patient A., for a week worried about weakness, loss of appetite, sleep disturbance, T 37.1 - 37.2 ° C. On day 7 T 38.9 ° C, headache, vomiting, meningeal

signs are weakly expressed. In the following days, the condition worsened. Is inhibited. Ptosis, strabismus, smoothness of the nasolabial fold. The positive reflex of Babinsky. Liquor flows under pressure, cytos 350 cells in 1  $\mu$ l, lymphocytes 72%, protein 2.1 g / l, sugar 1.5 mmol / L. A - meningococcal meningitis; B \* - tuberculous meningoencephalitis; C - enteroviral meningitis; D - flu, serous meningitis; E - subarachnoid hemorrhage.

60. The antibiotic of choice for tuberculous meningitis is: A - penicillin; B \* - rifampicin; C is ceftriaxone; D - linkamycin; E - chloramphenicol succinate.

61. Patient A., a shepherd, was admitted to the hospital on the 6th day of illness with complaints of T 38 - 39 ° C, headache, vomiting, weakness, severe pain in the calf muscles, there was nosebleed twice. Sclera is icteric, liver + 2 cm, positive symptoms of Pasternatsky, Kernig, upper Brudzinsky. Liquor: cytos 800 cells. in 1  $\mu$ l, lymphocytes 52%, protein 0.9 g / l, sugar 2.6 mmol / l. A \* - leptospirosis meningitis;

B - enteroviral encephalitis, C - influenza meningitis; D - viral hepatitis, meningism; E - meningococcal meningitis.

62. The diagnosis of leptospirosis meningitis is confirmed by the identification of the pathogen in: A - blood; B \* - cerebrospinal fluid by PCR; C - urine; D - kale; E - that's right.

63. The drug of choice in the treatment of leptospirosis meningitis is: A - tetracycline; B - levomycetin - succinate; C is erythromycin; D \* - penicillin; E - all are equally effective.

64. Patient A., 18 years old. During the week T -38.5 - 40 ° C, severe intoxication, lymphadenopathy, myositis, chorioretinitis. Liquor – Cytosis 120 cells in 1  $\mu$ l, lympho-monocytic, protein - 0.4 g / l, sugar - 3.1 mmol / l. It can be assumed: A - leptospirosis, meningism; B \* - toxoplasmosis meningitis; C - enteroviral meningitis; D - meningococcal meningitis; E - candidal meningitis.

65. The drug of choice for toxoplasmosis meningitis is: A - chloramphenicol succinate; B \* - pyrimethamine; C-oseltamivir; D - acyclovir; E - all equally effective.

66. Primary purulent bacterial meningitis in 80% of cases is caused by: A - pneumococcus; B - leptospira; C - staphylococcus; D \* - meningococcus; E - Salmonella.

67. Patient K., became acutely ill: T 39.5 ° C, headache, vomiting, photophobia, hyperacusis. Positive symptoms of Kernig, Brudzinsky, Matus. Liquor flows out under pressure, turbid, cytos of 1100 cells. in 1 µl, neutrophils 85%, protein 1.5 g / l, sugar 2.8 mmol / l. A - tuberculous meningitis; B - leptospirosis, meningism; C - pneumococcal meningitis; D \* - meningococcal meningitis; E - staphylococcal meningitis.

68. Everything relates to late complications of meningococcal meningoencephalitis, with the exception of: A \* - edema-swelling of the brain; B - epilepsy; C - deafness; D - blindness; E - mental retardation.

69. In the hemogram with meningococcal meningitis most often detected: A - leukopenia; B - normal white blood cell count; C \* - leukocytosis with neutrophilia; D - leukocytosis with lymphocytosis; E - ESR 8 mm hour.

70. Liquor taken from a patient with meningococcal meningitis, to identify the pathogen must be seeded on Wednesday: A \* - blood agar; B - 1% peptone water; C - gall broth; D - Ploskirev's environment; E - Saburo.

71. Liquor taken from a patient with meningococcal meningitis should be stored before being sent to the laboratory: A - to the freezer; B - in the refrigerator; C - at room temperature; D \* - in the thermostat at T 37 ° C; E - all of the above is true.

72. The antibiotic of choice for meningococcal meningitis is: A - streptomycin; B \* - penicillin; C - chloramphenicol succinate; D is erythromycin; E is tetracycline.

73. In a patient weighing 80 kg with meningococcal meningitis, the daily dose is: A - 200 thousand units; B - 300 thousand units; C - 3 mln units; D \* - 24 million units; E - 120 million units.

74. The main method of antibiotic infusion for meningococcal meningoencephalitis is: A - oral;

B - intramuscularly; C \* - intravenously; D - a combination of oral and intramuscular; E - the method of antibiotic administration does not matter.

75. What cerebrospinal fluid during control puncture in a patient with meningococcal meningitis can cancel the antibiotic?: A \* -30 cells. in 1  $\mu$ l, 80% of lymphocytes; B - 25 cells in 1  $\mu$ l., 68% neutrophils; C - 90 cells in 1  $\mu$ l., 55% neutrophils; D - protein 0.33 g / l, E - sugar - 3.1 mmol / l.

76. In meningitis + meningococemia presence (during the first hours of the disease) purpura requires infusion of: A - vikasol; B - dicinol; C - intravenous administration of ascorbic acid; D - the introduction of red blood cells; E \* - heparin.

77. Patient K., within 1.5 days T 39.5 ° C, headache, vomiting, hyperacusis. Hip hemorrhagic rash. Stiff neck. Preliminary diagnosis?: A - meningococcal meningitis; B - meningococcal encephalitis; C \* - meningococcal meningitis, meningococemia; D - leptospirosis meningitis; E - tuberculous meningitis.

78. The antibiotic of choice for meningitis + meningococemia with signs of endotoxic shock is: A is benzylpenicillin; B \* - chloramphenicol-succinate; C is tetracycline; D - vancomycin; E - lincomycin.

79. The main cause of death in meningococemia is: A - edema-swelling of the brain; B \* - endotoxic shock; C - acute heart failure; D - pulmonary edema; E - acute renal failure.

80. With pneumococcal meningitis, the primary focus of infection may be: A - chronic suppurative otitis media; B - sinusitis; C - endocarditis; D - open craniocerebral trauma; E \* - everything is right.

81. The patient was hospitalized on the first day of the disease. T 39.5 ° C, headache, vomiting, photophobia. The last 2 weeks received treatment for exacerbation of chronic suppurative otitis media. Inhibited, pale, nystagmus, hand tremor, positive finger-nasal test, smoothness of the nasolabial folds. Stiff neck. Positive reflexes of Babinsky and Oppenheim. Diagnosis: A - meningococcal meningitis; B - herpetic meningoencephalitis; C - tuberculous meningitis; D - enteroviral meningitis; E \* - pneumococcal meningoencephalitis.

82. The research material (for identifying the pathogen) in patients with pneumococcal infection may be: A - blood; B - cerebrospinal fluid; C - sputum; D - pus from the ear; E \* - everything is right.

83. The diagnosis of pneumococcal meningitis confirms the allocation of the pathogen from: A - blood; B \* - cerebrospinal fluid; C - purulent discharge and ear; D - mucus from the mouth of the pharynx; E - sputum.

84. The drug of choice for pneumococcal meningitis is: A \* - ceftriaxone; B - chloramphenicol succinate; C - gentamicin; D - vancomycin; E - lincomycin.

85. Brain abscesses are more often found in infections caused by: A - herpes viruses; B - meningococcus; C \* - staphylococcus; D - enteroviruses; E - Leptospira.

86. Spirochetosis includes all diseases, except: A - tick-borne relapsing fever; B \* - typhus; C - leptospirosis; D - tick-borne borreliosis; E - syphilis.

87. Meningitis caused by Lyme disease develops most often: A - in the first hours of the disease; B - on the 4th-5th day of illness; C - in the second week; D \* - after 1-2 months; E - everything is right.

88. For meningitis caused by Borrelia, a typical cerebrospinal fluid: A - lymphocytic pleocytosis - 8 cells; B - pleocytosis of 300 cells, 75% neutrophils; C \* - pleocytosis of 90 cells, 80% lymphocytes; D - xanthochromic liquor, white blood cells, fresh and altered red blood cells; E - everything is right.

89. The most informative method for the specific diagnosis of borreliosis meningitis is: A - type of cerebrospinal fluid; B - determination of the titer of anti-borreliosis antibodies in blood serum; C - determination of the titer of anti-borreliosis antibodies in cerebrospinal fluid; D \* - calculation of cerebrospinal fluid– serum index in the determination of specific antibodies; E - biological method.

90. Etiotropic therapy of tick-borne borreliosis is the appointment: A \* - antibiotics; B - immunoglobulin; C - oseltamivir; D - acyclovir; D - vaccine.

91. What is the osmolarity of blood plasma that allows the use of osmotic diuretics to treat cerebral edema-swelling? A. \* no more than 320 mosm / l; B. not less than 320 mosm / l; C. 300 mosm / l; D. 250 mosm / l; E. 400 mosm / l.

92. Brain swelling is: A. - an increase in brain volume due to fluid accumulation in the interstitial space; B. - an increase in brain volume due to intracellular fluid; C \*

.- an increase in brain volume due to intracellular fluid and fluid accumulation in the interstitial space; D. - all answers are correct; E. - all answers are incorrect.

93. The clinical manifestations of edema-swelling of the brain are: A. - loss of consciousness; B. - the presence of focal neurological deficit; C. - cramps; D. - the presence of stem symptoms; E \*. - all answers are correct.

94. Everything is typical for the diencephalic stage of wedging into the Tentorium cerebelli, with the exception of: A. - flickering consciousness with a deepening of oppression of consciousness to stunning; B. - a pronounced increase in focal symptoms; C\*. - progressive oppression of consciousness (stupor, coma); D. - pupil symmetry, attenuation of photoreaction; E. — Preservation of tendon reflexes.

95. Convulsive syndrome with edema-swelling of the brain is mainly due to: A. - depolarization of cells due to the accumulation of  $\text{Na}^+$  in interstitium; B. - depolarization of cells due to  $\text{Ca}^{2+}$  accumulation in interstitium; C. - the presence of "false mediators"; D. \* - depolarization of cells due to the accumulation of  $\text{K}^+$  in interstitium; E. - all answers are correct.

96. The trigger mechanism for swelling brain cells is: A\*. - hypoxia; B. - disruption of the operation of ion pumps; C. - intracellular metabolic acidosis; D. - accumulation of sodium ions intracellularly; E. metabolic alkalosis.

97. What dose of glucocorticosteroids is used in case of cerebral edema with neuroinfections: A. 2 mg / kg; B. 5 mg / kg; C\*. 10-15 mg / kg; D. 30-35 mg / kg; E. All answers are correct.

98. An increase in intracranial pressure during neuroinfection occurs due to: A. - an increase in the volume of the brain parenchyma; B. - increase in volume of cerebrospinal fluid; C. - increase in the volume of deposited blood; D \*. - everything is right; E. - all is not true.

99. Everything is typical for characterization of the blood-brain barrier, except: A. - the capillary endothelial cells are the morphological basis; B. - capillary endothelium permeable to  $\text{Na}^+$  ions; C. - provides maintenance and regulation of neural homeostasis; D \*. - capillary endothelium permeable to proteins; E. - capillary endothelium permeable to water molecules.



100. Patient K., has 4 days with a diagnosis of "Pneumococcal meningoencephalitis. Cerebral edema. " Objectively: there is no productive speech contact with the patient, the patient groans, does not fulfill the command. The pupils are narrow, the reaction to light is preserved. It responds to painful stimuli with targeted hand movements. Meningeal signs are sharply positive. Reflexes saved. T-39 ° C, blood pressure 120/80 mm Hg, pulse 130 per minute. Chain-Stokes breathing. Determine the level of impaired consciousness: A. - moderate stunning; B\*. - stupor; C. - coma I; D. - coma III; E. - Deep Stun.

## RECOMMENDED LITERATURE

### *Basic*

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3. Infectious diseases : textbook for students of higher medical establishments / O. A. Holubovska [et al.] ; ed. by.: O. A. Holubovska. - Kyiv : AUS Medicine Publishing, 2018. - 664 p.

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