LECTURE COMPLEX

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Lecture №1

1. Topic: The doctrine of immunity. Basic principles of organization and functioning of the immune system.

2. Objective: To give information to students about the organs and tissues of the immune system, immunocompetent cells and their functions. To acquaint with immunity, its types and forms.

3. Abstracts of the lecture.

Immunology is a science that studies immunity and the use of immunological concepts and methods in other areas of science and practice.

By origin, immunology is an applied medical science. Its prehistory is more than 2 thousand years old. During this time, the main approach in this field has been an empirical search for ways to prevent infectious diseases. At the heart of this search was the reliable observation that people who had some "contagious diseases" did not get sick again. This fact was clearly manifested in smallpox - it was this disease that became the "springboard" for the formation of immunology.

The birth of immunology as a science is associated with the name of L. Pasteur. It is widely known that L. Pasteur created microbiology and proved the role of microorganisms in the development and spread of contagious (infectious) diseases. L. Pasteur introduced the term - immunity. It comes from the Latin immunitas - liberation.

Immunity is a special biological property of multicellular organisms, aimed at protecting against genetically alien factors: microorganisms (bacteria, viruses, protozoa, fungi), foreign molecules, etc. Immunity also ensures the body's immunity to infection upon repeated encounter with a pathogen.

The immune system is a combination of lymphoid organs and accumulations of lymphoid cells. The total mass of lymphoid organs in a person is 1.0–2.5 kg. This is an independent system: it is generalized throughout the body, its cells are recirculated throughout the body through the bloodstream, it has the ability to produce specific antibodies to the antigen.

Currently, the main organs of the immune system are the organs of the lymphoid system. They are divided into central and peripheral lymphoid organs.

The central lymphoid organs include only the bone marrow and thymus. They serve as the basis for the basic development of lymphocytes.

Peripheral lymphoid organs include the spleen, lymph nodes, lymphoid tissue (tonsils, Peyrov's patches, etc.).

In addition, IS are divided into encapsulated organs: thymus, spleen, lymph nodes; non-encapsulated lymphoid tissue of the mucous membranes of the gastrointestinal tract, respiratory organs, lymphoid subsystem of the skin (lymphocytes of the skin, regional lymph nodes or lymphatic vessels) and other mucous membranes.

The organs of the immune system contain: afferent (blood flow or lymph), efferent (outflow) vessels; sinuses, zones of reproduction, maturation and differentiation of cells.

The theory of immunity is a doctrine generalized by experimental studies, which was based on the principles and mechanisms of action of immune defense in the human body.

4. Illustrative material: multimedia projector (presentation).

5. Literature: Application № 1

6. Security questions:

1. Define "immunity".
2. List the organs of the central immune system.
3. List the organs of the peripheral immune system.
4. Name the functions of the bone marrow.
5. Define the concept of "Immunoprophylaxis".
6. What are preventive vaccinations.

Lecture №2

1. Topic: Antigens. Antigen presenting cells. Antibodies. Cellular immune system.

2. Objective: To provide information to students about antigens, species and their features. Introduce the role in the induction and regulation of the immune response. Determination of the main functions of the T-system.

3. Abstracts of the lecture.

The ontogenesis of each macroorganism takes place in direct contact with cells alien to it, precellular life forms, as well as individual molecules of biological origin. All these objects, being alien, are fraught with great danger: contact with them can disrupt homeostasis, affect the course of biological processes, and even lead to the death of the macroorganism. Therefore, alien biological objects represent an evolutionarily formed early danger signal for the immune system: they are the main irritant and the end point of application of the acquired immunity system. The totality of such objects as phenomena of the biological world is called an antigen (from the Greek anti - against and genos - to create).

The modern definition of the term “antigen” is a naturally genetically alien organic biopolymer for macroorganisms, when it enters the body, the immune system recognizes it and causes immune reactions that destroy it. The concept of antigens is a critical factor in understanding the basic molecular genetic mechanisms of macroorganism immune defense (since the antigen is an immuno-responsive driving force) and the basis of the principles of immune-assisted treatment and prevention.

Theoretically, an antigen can be a molecule of any organic substance, both harmful to the macroorganism and harmless. In particular, antigens are components and waste products of bacteria, fungi, protozoa, viral particles, animal and plant

organisms. Antigens have a wide variety of origins. In essence, they are a product of the natural biological synthesis of any alien organism. In some cases, antigens can be formed in one's own body during structural changes of worse synthesized molecules during biodegradation, disruption of their normal biosynthesis (epigenetic mutation) or genetic mutation of cells. In addition, antigens can be obtained artificially as a result of human scientific or industrial activity, including by targeted chemical synthesis. However, in any case, the antigen molecule will be distinguished by genetic foreignness in relation to the macroorganism into which it has entered.

Antigens can penetrate into the macroorganism in a variety of ways: through the skin or mucous membranes, directly into the internal environment of the body, bypassing the covers, or forming inside it. Antigens are recognized by immunocompetent cells and cause a cascade of various immune responses aimed at their inactivation, destruction and removal. According to modern concepts, the doctrine of antigens is the key to understanding the basics of the molecular genetic mechanisms of the immune defense of a macroorganism, as well as the principles of immunotherapy and immunoprophylaxis.

Antigens are characterized by immunogenicity, antigenic and specific properties.

Antigenicity is understood as the potential ability of an antigen molecule to activate components of the immune system and specifically interact with immune factors. The antigen should act as a specific stimulus in relation to immunocompetent cells. At the same time, interaction with the components of the immune system does not occur with the entire molecule at the same time, but only with its small area, which is called the "antigenic determinant" or "epitope".

Immunogenicity - the potential ability of an antigen to cause a specific protective reaction in relation to itself in the macroorganism.

The degree of immunogenicity depends on a number of factors that can be grouped into three groups:

1. Molecular features of the antigen.
2. Antigen clearance in the body.
3. Reactivity of the macroorganism.

Specificity refers to the ability of an antigen to induce an immune response to a well-defined epitope.

Based on individual characteristic properties, the whole variety of antigens can be divided into several classification groups:

- by origin;
- by nature;
- by molecular structure;
- according to the degree of immunogenicity;
- according to the degree of foreignness;
- according to the direction of activation and security of the immune response.

By origin, exogenous (arising outside the body) and endogenous (arising inside the body) antigens are distinguished. Among endogenous, auto- and neoantigens deserve special attention.

Autogenic antigens (self-antigens), or antigens of one's own body, are structurally unchanged molecules synthesized in the body under physiological conditions. Normally, autoantigens do not cause an immune system reaction due to the formed immunological tolerance (immunity) or their inaccessibility for contact with immunity factors - these are the so-called barrier antigens.

Autoantigens should be distinguished from neoantigens that arise in the body as a result of mutations. After modification, the molecules acquire the features of foreignness.

By nature: biopolymers of protein (proteins) and non-protein nature (polysaccharides, lipids, lipopolysaccharides, nucleic acids, etc.). According to the molecular structure: globular (the molecule has a spherical shape) and fibrillar (the shape of the thread). According to the degree of immunogenicity: complete and inferior. Complete antigens have a pronounced antigenicity and immunogenicity - the immune system of a sensitive organism reacts to their introduction by the production of immunity factors.

Incomplete antigens, or haptens (the term was proposed by K. Landsteiner), on the contrary, are not capable of inducing an immune response in the body when administered under normal conditions, since they have extremely low immunogenicity. However, they have not lost their antigenicity property, which allows them to specifically interact with ready-made immunity factors (antibodies, lymphocytes).

According to the degree of foreignness: xeno-, allo- and isoantigens. Xenogenic (heterologous) - common for organisms at different stages of evolutionary development, for example, belonging to different genera and species.

Isogenic antigens (or individual) are common only for genetically identical organisms, for example, for identical twins.

A separate classification criterion is the direction of activation and the security of the immune response in response to the introduction of the antigen. Depending on the physicochemical properties of the substance, the conditions for its introduction, the nature of the reaction and the reactivity of the macroorganism, immunogens, tolerogens and allergens are distinguished.

Immunogens, when they enter the body, are able to induce a productive reaction of the immune system, which ends with the production of immunity factors (antibodies, antigen-reactive clones of lymphocytes). In clinical practice, immunogens are used for immunodiagnosis, immunotherapy and immunoprophylaxis of many pathological conditions.

A tolerogen is the exact opposite of an immunogen. When interacting with the system of acquired immunity, it causes the inclusion of alternative mechanisms leading to the formation of immunological tolerance or non-response to the epitopes of this

tolerogen. Tolerogens are used to prevent and treat immunological conflicts and allergies by inducing artificial non-response to individual antigens.

The allergen also affects the acquired immune system. However, unlike the immunogen, the effect produced by it forms a pathological reaction of the body in the form of immediate or delayed hypersensitivity. An allergen does not differ in its properties from an immunogen. In clinical practice, allergens are used to diagnose infectious and allergic diseases. Among immunogens, two groups of antigens are distinguished, differing in the need to involve T-lymphocytes in the induction of an immune response. These are T-dependent and T-independent antigens. The immune reaction in response to the introduction of a T-dependent antigen is realized with the mandatory participation of T-lymphocytes (T-helpers). Most of the known antigens are T-dependent. At the same time, the development of an immune response to T-independent antigens does not require the involvement of T-helpers. These antigens are capable of directly stimulating B-lymphocytes to antibody production, differentiation and proliferation, as well as inducing an immune response in athymic animals. T-independent antigens have a mitogenic effect and are able to induce a polyclonal reaction.

Superantigens should be distinguished from T-independent antigens. This is a conditional term introduced to refer to a group of substances, mainly of microbial origin, which can non-specifically cause a polyclonal reaction. In the body, bypassing the natural processing of the antigen, the whole molecule of the superantigen is able to fit into the cooperation of the antigen-presenting cell and the T-helper and disrupt the recognition of "friend or foe". It has been established that the superantigen molecule independently binds to the intercellular complex "class II histocompatibility antigen - T-cell receptor" and forms a false signal for recognition of a foreign substance. A huge number of T-helpers (up to 20% of the total mass or more) are simultaneously involved in the process of nonspecific activation, hyperproduction of cytokines occurs, followed by polyclonal activation of lymphocytes, their mass death due to apoptosis and the development of secondary functional immunodeficiency.

To date, superantigen properties have been found in staphylococcal enterotoxin, Epstein-Barr virus proteins, rabies, HIV, and some other microbial substances.

Antigen-presenting cells or antigen-presenting cells (APC) are cells that exhibit a foreign antigen in combination with major histocompatibility complex (MHC) molecules on their surface. T-lymphocytes can recognize such complexes with the help of T-cell receptors (eng. TCR). Antigen-presenting cells process the antigen and present it to T cells.

There are two types of antigen-presenting cells: "professional" and "non-professional".

T-cells are not able to recognize and, accordingly, respond to a "pure" antigen. Only an antigen that has been previously processed by other cells and presented by them in complex with MHC molecules becomes “visible” to T cells.

Professional APK. MHC-II molecules are expressed only on certain cells, which are called professional APCs. There are 3 types of such cells in humans: dendritic cells of bone marrow origin (DC), B-lymphocytes and macrophages. On their membranes, in addition to MHC-I and MHC-II molecules, there are all co-receptor molecules necessary for antigen presentation to T cells. They produce cytokines necessary to activate T-lymphocytes and trigger an immune response.

The endothelium can also perform the functions of APC. Probably, the expression of peptide-MHC complexes on endothelial cells serves as a specific signal that attracts effector lymphocytes from the circulation to the lesion, providing antigen-specific homing.

Of all the cells that have the definition of "dendritic" (which means "cells with processes"), only cells of bone marrow origin are classified as professional APCs. Such cells are widely represented in the body. There are many of them in integumentary tissues (for example, Langerhans cells in the skin), nasopharynx, lungs, intestines and stomach, in the blood (immature forms) and in lymphoid organs (mature, activated). If B-lymphocytes and macrophages have other, moreover, the main functions for them - the production of immunoglobulins in B-lymphocytes, phagocytosis and "digestion" in macrophages, then DC has no other functions, except for the presentation of antigens and the transmission of costimulatory signals to lymphocytes.

"Non-professional" antigen-presenting cells. “Non-professional” antigen-presenting cells normally do not contain molecules of the main histocompatibility complex of class II, but synthesize them only in response to stimulation by certain cytokines, for example, γ-interferon. “Non-professional” antigen-presenting cells include: skin fibroblasts, thymus epithelial cells, epithelial cells thyroid gland, glial cells, pancreatic β-cells, vascular endothelial cells.

Antibodies were the first antigen-recognizing molecules to be discovered, which by now have been studied more fully than other molecules of this group. The properties of antibodies are protein molecules called immunoglobulins. Thus, the term "immunoglobin" reflects the chemical structure of the molecule without taking into account its specificity for a particular antigen, while the term "antibody" defines the functional properties of the molecule and takes into account the specificity of a particular immunoglobulin for antigens.

An antibody is a special soluble protein with a specific biochemical structure - an immunoglobulin that is present in blood serum and other biological fluids and is designed to bind an antigen. The Encyclopedic Dictionary of Medical Terms contains the following definition: antibodies (“anti” + “bodies”) are human and animal blood serum globulins formed in response to the ingestion of various antigens (belonging to bacteria, viruses, protein toxins, etc.) and specifically interacting with these antigens.

Immunogloublins / antibodies exist in 2 forms: membrane (as part of BCR) and soluble (actual antibodies). Antibodies were discovered in 1890, when E. Behring and

S. Kitasato found that the sera of rabbits injected with diphtheria toxin acquired the ability to neutralize this toxin and have a therapeutic effect in diphtheria infections. Immunoglobulins as a kind of proteins were originally identified by electrophoresis in fractions of serum γ- and β-globulins [A. Tiselius (A. Tiselius), 1937]. They were later purified by chromatography and subjected to structural analysis using limited proteolysis [R. Potter (R. Potter)] and reduction of disulfide bonds [J. Edelman (G. Edelman)]. A great contribution to the study of antibodies was made by studies of homogeneous tumor (myeloma) immunoglobulins [S. Milstein (C. Milstein)], which ultimately led to the creation of hybridoma technology [G. Kehler (G. Kohler), S. Milstein, 1975], which made it possible to obtain monoclonal antibodies of a given specificity. With the help of hybridomas, monoclonal antibodies of the required specificity can be obtained. Finally, in the late 1970s, S. Tonegawa discovered the molecular basis for the formation of diversity in the antigen recognition ability of antibodies and described the phenomenon of somatic rearrangement of immunoglobulin genes.

The ability to produce antibodies occurs in embryos at the 20th week of pregnancy, after birth, the production of immunoglobulins begins, which increases in adulthood and decreases with aging.

The dynamics of antibody formation varies depending on the action of the antigen (antigen size), the frequency of action of the antigen, the state of the body and its immune system. The dynamics of antibody formation varies from the first and second steps of the antigen and consists of several stages. It is divided into latent, logarithmic, stationary and decreasing stages. During the latent period, antigen treatment and introduction into immunocalculated cells, the formation of antibody-specific cells, and the formation of antibodies begin. At this stage, the antibody is not detected in the blood. During the logarithmic phase, antibodies are separated from the plasma and enter the lymph and blood. In the stationary period, the amount of antibodies reaches a maximum and stabilizes, and then the level of antibodies begins to decrease. The first time the antigen arrives in the latent period - 3-5 days, logarithmic - 7-15 days, stationary - 15-30 days, the decline period - 1-6 months or more. The main sign of the primary immune response is the formation of IgM, then IgG.

The second entry of the antigen (secondary immune response) differs from the immune response: the latent phase is reduced to a few hours or 1-2 days, characterized by significantly higher levels of antibodies over a logarithmic period, which is long in subsequent periods and slowly decreases over several years. The secondary immune response differs from the first, the most important is the formation of IgG.

The difference between primary and secondary immune responses to antibody production is explained by the fact that when an antigen is first introduced, the immune system produces lymphocyte clones that carry immune sensory information about that antigen. Once again confronted with this antigen, immunological clones of lymphocytes rapidly increase and intensify during the antibacterial process.

During re-introduction of the antigen, the rapid and intensive development of the antibody is experimental: it is used to obtain immunized animals in diagnostic and therapeutic sera, as well as for the rapid development of immunity during vaccination.

Immunological memory is the ability of the human immune system to effectively and quickly respond to a pathogen (antigen) with which the body has had prior contact.

This memory is carried out by specific clones of T-cells and B-cells, which, due to the primary adaptation to the antigen, are more active.

The speed and efficiency of the secondary response is associated with both the activity of T-cells and B-cells. T cells of immunological memory should be distinguished from T cells of the body due to the difference in receptors on the cell surface. Immunological memory, carried out by B-cells, memory includes the following indicators:

▪The latent period of diseases is reduced, and the maximum concentration of antibodies is reached rather quickly. These indicators are different for different antigens, but on average, the latent period with a secondary B-cell response is reduced by several days.

▪The number of B cells that enter into a secondary response increases tenfold compared to the primary response, for example, the content of such cells in the spleen during an immune response to an antigen is one B cell per 10,000 pathogen cells, while in the secondary response, this ratio is already 1:100,000.

These properties of the secondary immune response are laid even during the development of the primary one. At this time, clones of B-cells accumulate, and the process of their differentiation takes place. In the secondary response of B cells, already prepared cells enter the reaction. In addition, the secondary response leads to an increase in the sensitivity of the receptors, which creates a greater affinity for the antigen and antibody.

The development of successful specific immunity is the final stage of the body's defense against infection, it allows the immune system to cope with the pathogen. After recovery, the body is characterized by the presence of memory cells and the absence of specific cells and antibodies. However, these signs do not yet indicate that the body has completely overcome the antigens of the pathogen. It is possible that the remains of a residual amount of bacterial cells or viruses that could “hide” from the immune system for a long time can be found for a long time.

The immunological specificity of T- and B-lymphocyte antigen recognition receptors is the result of random combinations of many genes encoding the structure of antigen-binding sites. Theoretically, the formation of about a billion different receptors is possible, including those that are able to recognize their own antigens. Immune cells with receptors that recognize their own antigens are called autoreactive. It is absolutely clear that the activation of autoreactive cells, and hence the damage to one's own tissues, is unacceptable. To prevent immune-mediated self-harm, mechanisms to maintain immune tolerance are implemented. Immune tolerance is the fundamental

property of the immune system to recognize its own antigens without developing effector reactions against them due to the destruction or inactivation of the corresponding autoreactive lymphocytes. Distinguish between the mechanisms of central tolerance, which unfold in the central immune organs, and the mechanisms of peripheral tolerance, which are realized, respectively, in the peripheral lymphoid organs. Depending on the type of immune cells, B-cell and T-cell tolerance are distinguished.

The specific function of immune defense is directly carried out by a numerous pool of cells of myeloid and lymphoid blood germs: lymphocytes, phagocytes and dendritic cells. These are the main cells of the immune system. In addition to them, many other cell populations (epithelium, endothelium, fibroblasts, etc.) can be involved in the immune response.

On the surface of the cytoplasmic membrane of cells of the immune system, there are special molecules that serve as their markers. With the help of specific antibodies against these molecules, it was possible to divide the cells into separate subpopulations.

According to the functional activity, the cells participating in the immune response are divided into regulatory, effector and APC. Regulatory cells control the functioning of the components of the immune system by producing immunocytokine mediators and ligands. These cells determine the direction of development of the immune response, its intensity and duration. Effectors are the direct executors of immune protection. They act on the object either directly or by biosynthesis of biologically active substances with a specific effect (antibodies, mediators, etc.)

APK perform a simple, but very responsible task. They capture, process (process by limited proteolysis) and present the antigen to immunocompetent cells (T-helpers) as part of a complex with MHC class 2. APCs lack specificity for the antigen itself. MHC class 2 may include both self and foreign oligopeptides.

The presence of MHC class 2 on the membrane is a mandatory, but not the only, sign of APC. The expression of co-stimulating factors (CD40, 80, 86) as well as many adhesion molecules is necessary for the implementation of professional activities. MHC2 provide close contact between APCs and T-helpers.

The most typical APCs belonging to the category of "professional" are (by activity) dendritic cells of bone marrow origin, B-lymphocytes and macrophages. Dendritic cells are almost 100 times more efficient than macrophages. The function of non-professional APCs can also, be performed by some other cells in a state of activation - these are epithelial and endotheliocytes.

The implementation of a targeted function of the immune defense of the macroorganism is possible due to the presence of specific antigen receptors (immunoreceptors) on the cells of the immune system. According to the mechanism of reception, they are divided into direct and indirect. Direct links directly bind to the antigen molecule. This is how the receptors of most subpopulations of lymphocytes

function. Indirect interact with the antigen molecule indirectly through the Fc fragment of the immunoglobulin molecule. This is the so-called Fc receptor (FcR).

There are features depending on the affinity of FcR. A high-affinity receptor can bind to intact IgE and IgG4 molecules and form a receptor complex in which an immunoglobulin molecule performs an antigen-specific co-receptor function. This is in basophils and mast cells. Low affinity recognizes immunoglobulin molecules that have already formed immune complexes. This is the most common type. This is in macrophages natural killer epithelial dendritic cells, etc..

The immune response is based on the close interaction of various cell populations. This is achieved through the biosynthesis of a wide range of immunocytokines by cells of the immune system. The cellular-elemental composition of the immune system is constantly renewed.[6]

The T-system of immunity destroys antigens presented on cells through direct interaction of cytotoxic T-cells (CD8 T-cells, T-killers) with altered self or foreign cells.

The second distinguishing feature of T cells is associated with the features of antigen recognition: T cells do not recognize the antigenic peptide (epitope) itself, but its complex with MHC class I or II molecules.

In cases where the antigen forms a complex comprising MHC class I molecules, recognition and destruction is carried out, as just mentioned above, by cytotoxic CD8 T cells.

In cases where the antigen forms a complex with MHC class II molecules, either inflammatory CD4 T cells (TH1) or helper CD4 T cells (TH2) enter into the process of interaction with such a complex. (The former name of the cells of the TH1 subpopulation is T-inducers).

By definition, the T-system of immunity includes:

- thymus - a place of differentiation of bone marrow precursors of T-cells (pre-T-cells) to potentially mature forms;
- different subpopulations of T cells proper and
- a group of cytokines produced by these cells.

The main functions of the system are associated with providing a cellular form of immune response:

- firstly, by cytotoxic (killer) destruction of genetically different cells and tissues (foreign transplants, cancerous and virus-transformed cells) and
- secondly, participation in the regulation of both the cellular immune response and the humoral response through the inclusion of T-helpers, T-suppressors and T-cell cytokines in the immune process.

T cells are characterized by the following features:

1. Clonal organization of the T-cell pool - the ability of the descendants of one cell (clone) to respond to only one of the many antigenic peptides (this property of T-cells is common with B-cells).

2. The nature of recognition of a foreign antigen: unlike the surface immunoglobulins of B cells, which recognize the antigenic epitope itself, the antigen-recognizing receptor of T cells (TCR) interacts with the complex: antigenic epitope-MHC molecules.

3. Division of T-cells into subpopulations: T-killers / T-suppressors and T-helpers / T-cells of inflammation.

T-lymphocytes form three main subpopulations:

1) T-killers carry out immunological genetic surveillance, destroying mutated cells of their own body, including tumor cells and genetically alien transplant cells. T-killers make up to 10% of T-lymphocytes in peripheral blood. It is T-killers that, by their action, cause rejection of transplanted tissues, but this is also the first line of defense of the body against tumor cells;

2) T-helpers organize an immune response by acting on B-lymphocytes and giving a signal for the synthesis of antibodies against the antigen that has appeared in the body. T-helpers secrete interleukin-2, which acts on B-lymphocytes, and g-interferon. They are in peripheral blood up to 60-70% of the total number of T-lymphocytes;

3) T-suppressors limit the strength of the immune response, control the activity of T-killers, block the activity of T-helpers and B-lymphocytes, suppressing the excessive synthesis of antibodies that can cause an autoimmune reaction, that is, turn against the body's own cells.

In the process of differentiation of T-lymphocytes, two main stages are distinguished:

1. Antigen-independent differentiation - occurs constantly in the thymus.

2. Antigen-dependent differentiation - occurs in the peripheral organs of the immune system only when a T-lymphocyte comes into contact with an antigen.

4. Illustrative material: multimedia projector (presentation)

5. Literature:

6. Security questions:

1. Types of immunity.
2. What are antibodies.
3. What is the reaction of the humoral type.
4. What is the reaction of the cell type.
5. Functions of antibodies.
6. List the classes of antibodies.
7. What is avidity.
8. What are antigens.
9. What are haptens.
10. Name antigens of non-microbial origin.
11. Define "antigen-presenting cells".
12. Decipher the concept of "professional" antigen-presenting cells.

13. Decipher the concept of "unprofessional" antigen-presenting cells.

Lecture №3

1. Topic: Serological reactions.

2. Objective: To acquaint students with the main methods of immunological diagnostics.

3. Abstracts of the lecture.

Reactions of antigens with antibodies are called serological or humoral, because the specific antibodies involved are always present in the blood serum. Reactions between antibodies and antigens that occur in a living organism can be reproduced in the laboratory for diagnostic Objectives. Serological reactions of immunity entered the practice of diagnosing infectious diseases in the late 19th and early 20th centuries. The use of immunity reactions for diagnostic Objectives is based on the specificity of the interaction of an antigen with an antibody. Determination of the antigenic structure of microbes and their toxins made it possible to develop not only diagnosticums and therapeutic sera, but also diagnostic sera. Immune diagnostic sera are obtained by immunizing animals (for example, rabbits). These sera are used to identify microbes or exotoxins by antigenic structure using serological reactions (agglutination, precipitation, complement fixation, passive hemagglutination, etc.). Immune diagnostic sera treated with fluorochrome are used for express diagnostics of infectious diseases by the method of immune fluorescence.

Immunoprophylaxis and immunotherapy are sections of immunology that study and develop methods and methods for the specific prevention, treatment and diagnosis of infectious and non-infectious diseases using immunobiological drugs that affect the function of the immune system, or whose action is based on immunological principles.

Immunoprophylaxis is aimed at creating active or passive immunity to the causative agent of an infectious disease, or its antigen, as well as a pathogen in order to prevent a possible disease by forming the body's resistance to them. Immunotherapy is aimed at treating an already developed disease, which is based on a dysfunction of the immune system, or the immune system plays a leading role in restoring homeostasis, i.e. restoring health. Immunoprophylaxis and immunotherapy are used in cases where it is necessary: a) to form, create specific immunity or activate the immune system; b) suppress the activity of individual parts of the immune system; c) normalize the work of the immune system, if there are deviations of its function in one direction or another. Immunoprophylaxis and immunotherapy are widely used in various fields of medicine, primarily in the prevention and treatment of infectious diseases, allergies, immunopathological conditions, oncology, transplantology, primary and secondary immunodeficiencies and other diseases.

At the same time, immunoprophylaxis, and sometimes immunotherapy, are the only or leading methods among other medical interventions for the prevention or

treatment of diseases. For example, the prevention of poliomyelitis, measles and other mass infectious diseases cannot be imagined without vaccination. Only thanks to vaccination, smallpox has been eliminated on the globe, it is planned to eliminate poliomyelitis by 2005, there are no all-encompassing epidemics of childhood, especially dangerous and other infectious diseases. In the treatment of such toxin infections as botulism, tetanus, serotherapy, i.e., the use of antitoxic sera, and immunoglobulin are of leading importance. In the treatment of oncological diseases, immunocytokines are increasingly being used. Diagnostic immunopreparations have become an integral part of the medical arsenal in clinics for infectious and non-infectious diseases. As mentioned, the principle of immunoprophylaxis and immunotherapy comes down to one or another effect on the immune system, i.e., to activation, suppression or normalization of its work. This influence can be active or passive, specific or non-specific. For such a differentiated effect on the immune system, which the ion uses in immunoprophylaxis and immunotherapy, many drugs have been developed, united in a group called ishu * nobiological drugs (IBPs).

Infectious agents as immunogens. Launch of anti-infective immunity The foundations of fundamental immunology were created on the basis of experimental studies using model systems, which cannot always be identified with the natural processes that occur when organisms are infected. Therefore, it makes sense to correlate all the general patterns of immunity with their specific manifestations in infectious diseases. You should start with the events associated with the launch of immune responses during infectious processes. The routes of penetration of infectious agents determine not only the localization of the pathological process, but also the features of immune defense. In the vast majority of cases, infectious agents enter the body through the mucous membranes in three main tracts - respiratory, digestive and urogenital. In this regard, the earliest immunological events in infectious processes are associated with the immune system of the mucous membranes. In the early stages of infection, the mucosal response is mediated by the involvement of cells and humoral factors of innate immunity. Further processes may be limited to the organs into which the infectious agent has penetrated, especially when the latter has a tropism for cells of certain types, which is especially characteristic of intracellular pathogens. However, more often the infectious factor tends to spread by lymphogenous or hematogenous routes. By the lymphogenic route, it enters the regional lymph nodes, which become the next (after the penetration site) platform for the implementation of immune protection. In the lymph nodes, cells and humoral factors of adaptive immunity initiated at this stage of the process are connected to the factors of innate immunity. Overcoming this barrier leads to the generalization of an infectious disease, and then to the spread of immune processes to the systemic level, which does not always lead to an adequate result and borders on the state of pathology, caused by the damaging effect of not only infectious agents, but also the immunity factors themselves. Significance for immune processes of localization of infectious agents outside or inside the cell As

shown above (see Section 3.6), depending on the localization of the pathogen, various mechanisms of immune defense are adequate (i.e., effective) (Table 4.1). Extracellular pathogens can be neutralized by antibodies, with the help of which effector factors of innate immunity can be attracted to them. Pathogens localized in granules can be destroyed by factors of innate immunity (bactericidal components of phagocytes), stimulated by T-lymphocytes and their cytokines. Pathogens integrated into the genome or localized in the cytosol are destroyed together with the infected cell by cytotoxic lymphocytes - natural (NK) or adaptive (T). Finally, special (still not fully characterized) methods of protection are addressed to extracellular pathogens localized on the surface of the mucous membranes.

Immunological tolerance is a phenomenon opposite to the immune response and immunological memory. It manifests itself in the absence of a specific productive immune response of the body to the antigen due to the inability to recognize it.

In contrast to immunosuppression, immunological tolerance implies the initial unreactivity of immunocompetent cells to a specific antigen.

Upon repeated encounter with the antigen, the body forms a more active and faster immune response - a secondary immune response. This phenomenon is called immunological memory.

The immunological specificity of T- and B-lymphocyte antigen recognition receptors is the result of random combinations of many genes encoding the structure of antigen-binding sites. Theoretically, the formation of about a billion different receptors is possible, including those that are able to recognize their own antigens. Immune cells with receptors that recognize their own antigens are called autoreactive. It is absolutely clear that the activation of autoreactive cells, and hence the damage to one's own tissues, is unacceptable. To prevent immune-mediated self-harm, mechanisms to maintain immune tolerance are implemented. Immune tolerance is the fundamental property of the immune system to recognize its own antigens without developing effector reactions against them due to the destruction or inactivation of the corresponding autoreactive lymphocytes. Distinguish between the mechanisms of central tolerance, which unfold in the central immune organs, and the mechanisms of peripheral tolerance, which are realized, respectively, in the peripheral lymphoid organs. Depending on the type of immune cells, B-cell and T-cell tolerance are distinguished.

Immunological memory has a high specificity for a particular antigen, extends to both humoral and cellular immunity and is caused by B- and T-lymphocytes. It is formed almost always and persists for years and even decades.

4. Illustrative material: multimedia projector (presentation)

5. Literature: Application №1

6. Security questions:

1. Serological and immunological reactions, their practical application in medicine.
2. Groups of serological reactions.

3. Agglutination reaction.
4. Drugs used for immunoprophylaxis and immunotherapy of infectious diseases.
5. Classification of vaccines depending on the methods of obtaining.
6. Methods for obtaining immunoglobulins

Lecture №4

1. Topic: Pathogens of purulent-inflammatory and purulent-septic infections.

2. Objective: To acquaint students with the biological properties of staphylococci, streptococci, meningococci and gonococci, as well as with the methods of microbiological diagnostics.

3. Abstracts of the lecture.

The subject of study of private medical microbiology are pathogenic microorganisms that cause human infectious diseases. Cocci are widely distributed in nature, there are a large number of species, and only a few of them cause diseases in humans. In the vast majority of cases, we are talking about purulent-inflammatory processes of various localization.

Cocci are a large group of microbes with a similar morphology: cocci cells are spherical in shape. Cocci include: staphylococci, streptococci, enterococci, pneumococci, peptococci, peptostreptococci, neisseria, veillonella, etc. Among cocci there are both gram-positive and gram-negative microbes; according to the type of respiration, aerobic, microaerophilic, facultative anaerobic and obligate anaerobic cocci are found.

Staphylococcus was discovered in 1878 by R. Koch and 1880 by L. Pasteur in purulent material. The name "staphylococcus" was given in 1881 by A. Ogston (due to the characteristic arrangement of cells), and F. Rosenbach described its properties in detail. The staphylococcus genus includes 26 species.

Staphylococcus belongs to the Micrococcaceae family, Staphylococcus genera. Of these, it plays the role of human pathology:

S. aureus - Staphylococcus aureus

S. epidermidis - epidermal staphylococcus

S. saprophuticus - saprophytic staphylococcus.

Morphology. Staphylococci are gram-positive bacteria, spherical in shape, 0.5-1.5 microns in size, usually located in the form of grapes. They do not have flagella, do not form spores, most strains of S. aureus form a capsule, facultative anaerobes. The main components of the cell wall are peptidoglycan, ribiteichoic and glycerinteichoic acids.

Cultural properties. The main nutrient medium JSA. When growing on yolk-salt agar, they form cloudy round even colonies of cream, yellow or orange color. The color of the colonies is due to the presence of lipochromic pigment; its formation occurs only in the presence of oxygen and is most pronounced in media containing blood, carbohydrates or milk, however, pigment formation is not a specific feature. On

the yolk-salt magar, colonies are formed, surrounded by an iridescent corolla due to the formation of the enzyme lecitovitellase. On blood agar they form colonies with a zone of hemolysis. On liquid media, a uniform turbidity is produced, and then a loose precipitate, which turns into a viscous mass.

By type of pigment formation

1.Staphulococcus aureus - golden pigment

2.Staphulococcus albus - white pigment

3.Staphulococcus citreus - lemon yellow pigment.

Biochemical properties. Staphylococci have catalase activity, reduce nitrates to nitrites, hydrolyze proteins and fats. Staphylococci have biochemical activity, ferment with the release of acid (without gas) glycerol, glucose, maltose, lactose, sucrose, mannitol.

Antigenic properties. Antigenic properties are possessed by peptidoglycan and teichoic acids of the cell wall, type-specific antigens, flocculating factor and capsule. Species-specific AGs are teichoic acids: for S. aureus, ribiteichoic acid, and for S. epidermidis, glycerinteichoic acid; S. saprophyticus reveal both types of acids.

Staphylococci can cause over 120 different diseases and affect any tissue and organ. Pathogenic factors include:

1. Adhesion factor.

2. Enzymes:

a) plasmocoagulase is the main pathogenic factor of staphylococci - it protects against phagocytosis and converts prothrombin into thrombin, which causes fibrinogen to coagulate, as a result of which each cell is covered with a protein film that protects against phagocytes;

b) fibrinolysin and hyaluronidase cause high invasiveness of staphylococci;

c) lecithinase, lysozyme, alkaline phosphatase, DNase, etc.

3. Complex of secreted toxins:

a) membrane-damaging toxins (hemolysins) - α, β, δ, γ, damaging membranes, each of these toxins destroys erythrocytes, leukocytes, macrophages, platelets, mastocytes, tissue culture cells, protoplasts and spheroplasts of bacteria;

b) exfoliative toxins A and B, the ability of staphylococci to cause pemphigus in newborns, bullous impetigo, scarlet fever-like rash is associated with these toxins;

c) true leukocidin - a toxin that differs from hemolysins in antigenic properties, selectively acts on leukocytes, destroying them;

d) exotoxin - causes toxic shock.

4. Factors with allergic properties.

5. Cross-reacting antigens.

6. Factors inhibiting phagocytosis - capsule, protein A, peptidoglycan, teichoic acids, toxins.

7. Mitogenic effect on lymphocytes - protein A, enterotoxins.

8. Enterotoxins.

Resistance. Staphylococci are most resistant to external factors, they tolerate desiccation and low temperatures well. At a temperature of 80 staphylococci die after 30 minutes. 3% phenol solution for 20 minutes, 1% chloramine solution for 2-5 minutes.

Staphylococci cause the following infections: a) autoinfections b) exogenous infections.

Transmission paths. Contact-household, airborne, alimentary. Bacteriocarriers play a special role in the transmission of infection in various health facilities.

DIAGNOSIS METHODS:

The material for the study is pus, blood, urine, sputum, swabs from the nasal mucosa, vomit, feces, etc.

Laboratory diagnostics includes bacterioscopic, bacteriological and serological methods.

The test material is sown on a dense elective medium of yolk-salt agar,

blood is preliminarily sown in sugar broth, and when growth appears in the broth, seeding is done on yolk-salt agar.

Bacterioscopic examination Smears for primary bacterioscopy are prepared from the material under study (with the exception of blood), stained according to the Gram method and microscoped.

bacteriological research. The test material is seeded with a loop on plates with blood and yolk-salt agar.

Express diagnostic methods: immunochemical, biochemical and molecular biological studies.

Immunochemical studies. They are based on the detection of antigens (toxins and enzymes) of the pathogen in the material from the patient using sensitive serological reactions.

Biochemical and molecular biological research. The test material obtained from the focus of infection is used to detect pathogen DNA using PCR. If the corresponding molecules are found, a preliminary diagnosis can be made.

Prevention. It is aimed at identifying carriers of Staphylococcus aureus, mainly among staff and maternity hospitals, in order to sanitize them.

Treatment. Staphylococcal infections are carried out with antibiotics and sulfa drugs. In septic processes, anti-staphylococcal immunoglobulin is administered. For the treatment of chronic infections, staphylococcal toxoid, an anti-vaccine is used, which stimulate the synthesis of antitoxic and antimicrobial antibodies.

Streptococci arranged in pairs or chains.

The genus Streptococcus includes several dozen species.

Morphology. Streptococci are gram-positive bacteria, spherical or ovoid in shape, 0.6-1.0 microns in diameter, immobile, do not form spores. Pathogenic streptococci form a capsule, are facultative anaerobes, but there are also strict anaerobes.

Cultural, biochemical properties. Sugar broth and blood agar are used for cultivation. On a dense medium, they form small colonies of three types: mucoid, rough and smooth. On blood agar, Streptococcus pyogenes forms small, pinhead-sized, cloudy round colonies. In sugar broth, streptococcus, unlike staphylococcus, gives near-wall growth in the form of flakes or grains, leaving the medium transparent.

According to the nature of growth on blood agar, there are α-hemolytic, β-hemolytic and non-hemolytic.

Streptococci ferment glucose, maltose, sucrose, and other carbohydrates to form acid without gas; they do not coagulate milk. They do not have proteolytic properties (except for some enterococci).

Classification:

Streptococci can be classified according to their growth pattern on 5% blood agar (blood agar):

1. a-hemolytic (cause incomplete hemolysis) - the colonies are surrounded by a greenish zone - Str. viridans (green streptococcus);

2. b-hemolytic (cause complete hemolysis) - the colonies are surrounded by a colorless transparent zone of hemolysis;

3. Gamma streptococci (non-hemolytic) - blood agar around the colonies is not changed.

Streptococcus pathogenicity factors:

1. Protein-M is the main factor of pathogenicity, determines the adhesive properties, inhibits phagocytosis, determines antigenic type-specificity and has the properties of a superantigen.

2. The capsule protects against phagocytosis.

3. Erythrogenin, a scarlet toxin, causes scarlet fever patients to develop a bright red rash on the skin and mucous membranes. It has a pyrogenic, allergenic, immunosuppressive and mitogenic effect, destroys platelets.

4. Hemolysin O destroys erythrocytes, has cytotoxic, leukotoxic and cardiotoxic effects.

5. Hemolysin S has hemolytic and cytotoxic effects.

6. Streptokinase activates fibrinolysin and increases invasive properties.

7. Aminopeptidase inhibits the mobility of neutrophilic phagocytes.

8. Hyaluranidase is an invasion factor.

9. Clouding factor - hydrolysis of serum lipoproteins.

10. Proteases - the destruction of various proteins.

11. DNases - DNA hydrolysis.

12. The ability to interact with the Fc fragment of IgG using the II receptor - inhibition of the complement system and phagocyte activity.

13. Pronounced allergenic properties.

Resistance. Streptococci tolerate low temperatures well, resistant to drying. At a temperature of 56 ° C, they die after 30 minutes, a 3-5% solution of carbolic acid and lysol kills them after 15 minutes.

Transmission paths. The source of streptococcal infection are sick people and bacteria carriers. The method of infection is airborne, contact-household, rarely alimentary.

Pathogenesis and clinic. A typical pathological lesion caused by hemolytic streptococcus is widespread cellulitis. The exudate contains few cells and consists mainly of a liquid containing a small amount of fibrin. Toxic products released by microbes help streptococci to overcome both intact tissue and inflammatory barriers. In this case, there is a tendency to infection of the lymphatic vessels of the affected side (regional). Most of the well-known forms of streptococcal infection are manifestations of cellulitis. Erysipelas is cellulitis of a specific area (superficial layers of the skin of the wings of the nose and nasolabial folds, as well as other areas of the skin), septic infection of the pharynx (tonsillitis) is cellulitis of the pharynx.

Immunological reactions of the body usually follow a streptococcal infection (more often, a sore throat). For example, acute rheumatic fever is a complication of angina caused by group A streptococci; a form of kidney disease (glomerulonephritis) follows a streptococcal infection of the upper respiratory tract or skin. The causative agents of scarlet fever are B-hemolytic streptococci of group A, which have the M-antigen and produce erythrogenin, infection occurs by airborne droplets, however, any wound surfaces can be the entrance gate. Immunity - the main role in its formation is played by antitoxins and type-specific M-antibodies.

Immunity is strong, long lasting, due to antitoxins and immune memory cells. The intensity of antitoxic immunity to erythrogenic toxin is tested in the Dick reaction.

Streptococcal infections are associated with many different pathological processes.

DIAGNOSIS METHODS:

From pathological material: blood, pus, mucus from the pharynx, nose, smears are prepared and microscoped, the rest of the material is inoculated on blood agar, then the isolated colonies that have grown are subcultured into test tubes with slant blood agar and sugar broth.

Bacterioscopic examination. Smears for primary bacterioscopy are prepared from pathological material (with the exception of blood), stained according to the Gram method and microscoped.

Bacteriological research. The test material is seeded on blood agar in a Petri dish. After incubation at 37C for 24 hours, the nature of the colonies and the presence of hemolysis zones around them are noted.

Then, the isolated culture is identified by antigenic properties, using a precipitation reaction. Serovar is determined in the agglutination reaction. Determine sensitivity to antibiotics.

Treatment. Specific prevention of streptococcal infections has not been developed. Treatment is carried out mainly with antibiotics.

4. Illustrative material: multimedia projector (presentation)

5. Literature: Application №1

6. Security questions:

1. Morphology of staphylococci.
2. Factors of pathogenicity of staphylococci.
3. Methods for diagnosing staphylococcal infection.
4. Morphology of streptococci.
5. Factors of pathogenicity of streptocci.
6. Diseases causing streptococci.
7. Morphology of pneumococci.

Lecture №5

1. Topic: Pathogenic clostridia. Causative agents of wound infections.

2. Objective: To consider microbiological methods for diagnosing tetanus, gas gangrene, botulism.

3. Abstracts of the lecture.

Pathogenic tanaerobes are so widely distributed in nature, weaving aerobic bacteria. Their natural habitat is the soil, especially its deep layers, from various reservoirs, wastewater, the intestinal tract of mammals and animals, birds, fish, humans. 20 kinds.

Bacteria of the genus Clostridium form oval or round spores, located subterminally, centrally or terminally. As a rule, spores have a diameter greater than the diameter of the vegetative cell, so the rod with the spore takes the form of a spindle. Pathogenic clostridia cause diseases when they enter wounds, i.e. are causative agents of wound infection. When ingested, they cause food poisoning.

Tetanus (tetanus) is an infectious disease characterized by tonic tension of the skeletal muscles and attacks of tetanic convulsions caused by damage to the central nervous system by a pathogen toxin.

Tetanus is found everywhere, mainly in rural areas of subtropical and tropical climatic zones. There are no single cases recorded in our country.

The causative agent of tetanus, C. tetani, was discovered in 1883 by N.D. Monastyrsky and 1884 - A. Nikolayer. In pure culture, the pathogen was obtained in 1889 by S. Kitazato. C. tetani are straight rods 2.4-5.0 μm long, 0.5-1.1 μm in diameter, sometimes forming thin filaments, peritrichous, do not form capsules, gram-positive. It forms an oval colorless spore located terminally, which makes it look like a tennis racket or drumstick.

Gas gangrene is a severe wound infection caused by yam bacillus of the genus Clostridium, which is characterized by a sharp severe course, rapidly advancing tyre, spreading necrosis, mainly from skeletal muscles with the development of toteks and gas formation, severe toxin toxicity, and the absence of pronounced inflammatory phenomena.

Some pathogens include: C.perfringens, C.novyi, tC.t septicum, tC.histoliticum, tC.sordelli etc. mmm

All ttt clostridia causative agents of anaerobic wound infection are large gram-positive t rods with subterminally located spores. C. perfringens is a non-motile bacterium (the rest of the pathogens are peritrichous), in the material wound on a medium with serum and forms capsules (others do not form).

Botulism - poisoning with botulinum toxin accumulated in food; characterized by damage to the nervous system.

The causative agent of the disease was first discovered in 1896 by E. Van Ermengem in the remains of sausage, as well as in the spleen and large intestines of people who died from botulism. This discovery was confirmed by S.V. Konstansov, who isolated C. Botulinum from red fish, which caused poisoning.

The causative agent of botulism is C. botulinum. These are large polymorphic rods with rounded ends, 4-9 μm long, 0.5-1.5 μm in diameter, gram-positive, mobile (peritrichous), do not form capsules, spores are oval, located subterminally.

4. Illustrative material: multimedia projector (presentation)

5. Literature: Application №1

6. Security questions:

1. Pathogenicity factors of clostridium tetany.
2. Emergency prophylaxis of tetanus.
3. Pathogenesis of gas gangrene.
4. Action of botulinum toxin.
5. Prevention of botulism

Lecture №6

1. Topic: Causative agents of intestinal infections.

2. Objective: To consider the microbiological diagnosis of escherichiosis, dysentery, salmonellosis, typhoid fever, paratyphoid fever, food poisoning (PTI).

3. Abstracts of the lecture.

Acute bacterial infections - diarrhea are among the most common diseases. Their causative agents are many types of bacteria, but most often - representatives of the Enterobacteriaceae family. It combines bacteria that have the following characteristics:

1) unity of morphology - short, non-spore-forming rods with rounded ends, movable or immobile, forming or not forming a capsule;

2) negative Gram stain;

3) fermentation of glucose (and a number of other carbohydrates) with the formation of acid and gas or only acid;

4) the absence, as a rule, of proteolytic properties;

5) facultative anaerobes or aerobes;

6) grow well on ordinary nutrient media;

7) habitat - the intestinal tract and respiratory tract.

8) Fecal-oral (in some cases - airborne) route of infection.

The family contains more than 30 genera and more than 100 species.

The main representative of the genus Escherichia is E. coli. E. coli was first isolated from human feces in 1885 by T. Escherich. The genus Escherichia is represented by 7 species.

E. coli are represented by straight rods, 0.4-0.6x2.0-6.0 μm in size, mobile due to peritrichous flagella.

Dysentery is an acute infectious disease characterized by severe intoxication of the body and a predominant lesion of the colon. Clinically, it is manifested by diarrhea (frequent loose stools), pain and tenesmus in the abdomen. The discharge contains blood, pus and mucus.

The pathogen was first discovered in 1888 by A. Chantemes and F. Vidal.

The causative agents of dysentery are a large group of biologically similar bacteria united in the genus Shigella, and includes more than 40 serotypes. These are short, motionless rods that do not form spores or capsules.

Salmonella are short gram-negative rods with rounded ends, 1.5-4 microns long. In most cases, motile (peritrichous), spores and capsules do not have. The Salmonella genus includes a single species, S. enterica, with seven major subspecies that differ in a number of biochemical traits. According to the serological classification of White and Kauffman, Salmonella have O-, H- and K-antigens. Salmonella serovars are divided into 67 serogroups based on a set of O-antigens. The number of serovars isolated on the basis of the H-antigen is constantly increasing (about 2500 serovars). There are two types of H-antigens in Salmonella: phase I and phase II.

Typhoid fever is a severe acute infectious disease characterized by general intoxication, bacteremia and damage to the lymphatic apparatus of the small intestine. The causative agent of typhoid fever was discovered in 1880 by K. Ebert. The causative agents of typhoid fever are S. typhi, S. paratyphi A, S. paratyphi B gram-negative rods 1-3.5 x 0.5-0.8 μm in size, peritrichs.

The genus Campylobacter includes aerobic or microaerophilic, motile vibrioid Gram-negative bacteria. The genus Campylobacter includes 13 species. In 1991, the genus Helicobacter (two species - H. pylori and H. mustelae) was isolated from it as an independent one. Main species: C. jejuni, C. coli, C. lari, C. fetus, H. pylori.

4. Illustrative material: multimedia projector (presentation)

5. Literature: Application №1

6. Security questions:

1. Features of immunity in escherichiosis.
2. The main factors of pathogenicity of shigella.
3. Specific prevention of typhoid fever.

Lecture №7

1. Topic: The causative agents of especially dangerous infections.

2. Objective: To analyze and explain to students the spread of zoonotic infectious agents, and methods of microbiological diagnosis of the patient.

3. Abstracts of the lecture.

Highly dangerous infections (HDI) are a group of acute contagious human diseases that are capable of sudden onset, rapid spread and wide coverage of the population. AEs are characterized by severe course and high mortality.

Plague is an acute infectious disease that proceeds according to the type of hemorrhagic septicemia. There are three known plague pandemics that have claimed millions of human lives. The first pandemic was in the 6th century AD. It killed about 100 million people - half the population of the Eastern Roman Empire. The second pandemic broke out in the 14th century. It began in China and affected many countries in Asia and Europe. About 65 million people died from it. The third plague pandemic began in 1894 and ended in 1938, killing 15 million people.

So, in recent years: in 1999, 9 cases of plague were registered in Kazakhstan, while 2 people died, in 2001 there were also deaths, and in 2003 130 people were hospitalized.

Plague is caused by a specific bacterium that was discovered in Hong Kong in 1893-94. simultaneously by two bacteriologists, French - A. Yersin, and Japanese - Kitasato, completely independently of each other. In honor of the French scientist, the pathogen was named Yersinia pestis. The genus Yersinia belongs to the Enterobacteriaceae family and includes 11 species.

The causative agent of brucellosis was discovered in 1886 by D. Bruce, who discovered it in a preparation from the spleen of a soldier who died of Maltese fever, and called it Maltese micrococcus. It was found that the main carrier of it are goats and sheep, and infection occurs when raw milk is consumed from them. A disease of humans and animals caused by Brucella. It was decided to call brucellosis. Brucellosis is a disease of humans and animals caused by bacteria belonging to the genus Brucella, and is divided into 7 species: B. melitensis (goats), B. abortus (cattle), B. suis (pigs), B. ovis (affects sheep), B. canis (dogs), B. neotomae (rats), B. rangiferis (reindeer).

A genus of non-motile Gram-negative, variously shaped bacteria ranging from spherical to rod-shaped, belonging to the group of zoonotic infections. They are capable of intracellular reproduction, which leads to their long stay in the body.

Tularemia is a primary disease of animals (rodents), in humans it occurs as an acute infectious disease with a diverse clinical picture and slow recovery. The

causative agent of tularemia, Francisella tularensis, was discovered by G. McCoy and S. Chepik in 1912 during an epizootic among ground squirrels in the area with Lake Tulare (California), studied in detail by E. Francis, after whom the genus is named. These are very small coccoid polymorphic rods, 0.2 x 0.2-0.7 μm in size, immobile, gram-negative, do not form spores. Virulent strains have a capsule.

Anthrax is an acute infectious disease of humans and animals. The Russian name for the disease was given by S. Andrievsky in connection with a major epidemic in the Urals at the end of the 18th century. Anthrax pathogens were first described by Polender in 1849 and later investigated by Koch and Pasteur. The causative agent of anthrax is Bacillus anthracis. This is a large rod up to 10 microns in size, gram-positive, no flagella, forms spores, the spore is located centrally, a capsule is formed only in the human body.

Cholera is a particularly dangerous infection. The disease belongs to the group of acute intestinal infections. The causative agent of cholera is vibrio cholerae (Vibrio cholerae 01). There are 2 biotypes of vibrios of serogroup 01, differing from each other in biochemical characteristics: classic (Vibrio cholerae biovar cholerae) and El Tor (Vibrio cholerae biovar eltor).

Vibrio cholerae carriers and cholera patients are a reservoir and source of infection. The most dangerous for infection are the first days of the disease.

Water is the main route of infection transmission. The infection also spreads with dirty hands through the patient's household items and food products. Flies can become carriers of infection.

The main symptoms of cholera are associated with dehydration. This results in copious (diarrhea). The stool is watery, odorless, with traces of desquamated intestinal epithelium in the form of "rice water".

The result of a simple stool microscopy helps to establish a preliminary diagnosis already in the first hours of the disease. The method of sowing biological material on nutrient media is a classic method for determining the causative agent of the disease. Accelerated methods for diagnosing cholera only confirm the results of the main diagnostic method.

Treatment of cholera is aimed at replenishing the fluid and minerals lost as a result of the disease and fighting the pathogen. The basis of disease prevention is measures to prevent the spread of infection and the ingress of pathogens into drinking water.

4. Illustrative material: multimedia projector (presentation)

5. Literature: Application №1

6. Security questions:

1. Name the factors of cholera pathogenesis.
2. Plague pathogenesis.
3. Name the factors of anthrax pathogenesis.

4. The temperature regime of the growth of the plague pathogen has been normalized.

5. What vaccine is used to prevent anthrax.

Lecture №8

1. Topic: Mycoses and pathogenic protozoa.

2. Objective: To acquaint students with the morphology and biological characteristics of mycoses and protozoa and their role in human pathology.

3. Abstracts of the lecture.

The German pathologist R. Virkhov for the first time in 1854 called fungal diseases of people and animals mycoses. One of the founders of medical mycology is the French scientist R. Saburo, who in 1910 published a monograph on trichophytosis, microsporia and favus.

Fungi are eukaryotes with a well-defined nucleus separated from the cytoplasm by a nuclear membrane.

Mushrooms include a large group of unicellular or multicellular organisms that are characterized by both signs of plants (immobility, unlimited apical growth, the ability to synthesize vitamins, the presence of cell walls) and animals (type of nutrition, the presence of chitin in cell walls, storage carbohydrates in the form of glycogen, urea formation, cytochrome structure). There are fungi - parasites, fungi - saprophytes and fungi - symbionts. Fungi - parasites infect living tissues of plants, animals and humans, causing various diseases called mycoses. Mushrooms - saprophytes feed on organic matter of dead tissues or excrement. Mushrooms - symbionts can enter into symbiotic relationships with the roots of higher plants, this group includes many cap mushrooms (bisidiomycetes), including those used for food and poisonous.

Fungi that parasitize in the human body cause mycoses that occur with lesions of the skin, its appendages or internal organs.

Fungal cells are covered with a dense cell membrane, consisting of polysaccharides close to cellulose and nitrogenous substances similar to chitin. In most fungi, the vegetative body (mycelium) consists of a system of thin branching filaments called hyphae. Intertwining, the mycelium forms a mycelium. Hyphae are able to grow in length and develop on the surface or inside the nutrient substrate. Accordingly, the mycelium is substratum (vegetative), growing into the nutrient medium, and aerial mycelium. The ends of the mycelium threads can be twisted in the form of spirals, curls, etc.

Fungi reproduce using a variety of structures. During the formation of sexual spores, meiosis takes place, and conidia are non-sexual reproductive organs. Sexual stages are found in many pathogenic fungi belonging to the classes Ascomycetes and Zygomycetes. In other pathogenic fungi, which belong to deteromycetes, sexual forms

of reproduction have not been identified. In mushrooms of medical importance, there are the following types of sexual spores:

1. Zygospores - in some zygomycetes, the tops of hyphae located close to each other merge, meiosis occurs, and large zygospores with thick walls are formed.

2. Ascospores - in special, called asci (bags), in which meiosis occurred, 4-8, sometimes 16 or more spores are formed, the size, shape and surface of which can be very diverse in different types of fungi.

3. Basidiospores - after meiosis, on the surface of a special cell called the basidium, at the top of each of the four sterigmata, one round or slightly elongated basidiospore of various sizes develops.

In most fungi of medical importance, a variety of conidia are found, which are forms of asexual reproduction. The most common types of conidia are the following types of spores:

1. Blastospores - simple structures that are formed as a result of budding, followed by separation of the kidney from the parent cell, for example, in yeast and yeast-like fungi;

2. Chlamydospores - hyphal cells increase, they form a thick shell. These structures are highly resistant to the action of adverse environmental factors and germinate when conditions become more favorable;

3. Arthrospores - structures that are formed as a result of the fragmentation of hyphae into individual cells. They are found in yeast-like fungi, the causative agent of coccidioidomycosis, tissue forms of dermatophytes in the hair, skin scales and in the nail;

4. Conidiospores - mature external spores - are formed on the mycelium and are not the result of the transformation of any other cells of the mycelium.

Almost all pathogenic fungi are aerobes: a wide supply of oxygen contributes to the development of mycelium and the accumulation of waste products. Mushrooms need nitrogenous and carbon-containing substances (as well as mineral compounds) to feed, and these substances can be quite simple: amino acids, nitrogen salts, di- and monosugars, etc. Pathogenic fungi are able to multiply in the pH range from 3.0 to 10.0; the optimal pH value is 6.0-6.5. The optimal temperature for the development of mycelial forms is 25-33 C, for yeast and yeast-like forms - 36-37 C. Fungal sporulation is facilitated by a decrease in the humidity of the nutrient medium and a reduced content of proteins and carbohydrates in the medium.

The enzymatic activity of pathogenic fungi is very diverse, its intensity varies widely both in different fungi and in the same fungus under different conditions of existence. Some mushrooms have more pronounced proteolytic activity, others have saccharolytic activity, and some have lipolytic activity. Some mushrooms have a wide range of enzymes and assimilate a wide variety of carbohydrates, while others, on the contrary, are able to consume only a very limited number of nitrogenous substances and carbohydrates. The depth of decomposition of nutrient substrates by fungi is also

different: some of them decompose proteins only to amino acids, others to ammonia and hydrogen sulfide. The consumption of carbohydrates by some fungi is accompanied only by the formation of organic acids, while others oxidize them to water and carbon dioxide.

Vitamins, some amino acids and trace elements for various mushrooms are important growth factors.

On liquid nutrient media, many fungi grow in the form of a felt-like sediment, first at the bottom, and then in the form of a parietal ring or a continuous film. According to the nature of growth on dense nutrient media, fungal colonies are divided into several types:

1. Leathery, smooth, dense texture, difficult to separate from the surface of the medium;

2. Fluffy, loose, cotton-like consistency, easily bent to the substrate when touched, difficult to remove with a loop;

3. Velvety hairy colonies, covered with very short dense mycelium resembling velvet;

4. Fragile, membranous, resembling brittle cardboard in consistency, with a very short lawn of aerial mycelium, densely powdery when spore formation;

5. Gypsum-powdery superficial colonies of powdery consistency; flouriness completely or star-shaped foci covers the colony and is easily separated from the surface of the culture;

6. Fine-grained or bumpy, leathery consistency, closely associated with the environment, often with deep offspring into the environment;

7. Coarsely bumpy, line-shaped, very fragile texture, easily separated from the substrate;

8. Shiny, greasy or dull, creamy consistency, sometimes mucus-viscous, quite easily emulsified in saline.

Diseases caused by pathogenic fungi can be conditionally divided into two groups: systemic, or deep, mycoses and superficial mycoses. Mycoses caused by opportunistic fungi can have a mixed clinical course.

Pathogenic fungi usually do not produce exotoxins. In the host organism, they tend to cause the development of hypersensitivity to their various antigens. In systemic mycoses, a typical tissue reaction is the development of a chronic granuloma with varying degrees of necrosis and abscess formation. In addition, there is a group of diseases called mycotoxicoses, which are caused by the ingestion of mycotoxins formed during the life of a number of microscopic mold fungi. More than 300 types of mycotoxins produced by representatives of 350 species of fungi have been identified, but only about 20 are of practical importance as food contaminants. Among them, aflatoxins B1, B2, G1, G2, M1 are the most common and dangerous to human health (producers are fungi of the genus Aspergillus) , trichothecene mycotoxins (including deoxynivalenol and zearalenone, produced by fungi of the genus Fusarium),

ochratoxins, citrinin, citreoviridin (produced by fungi of the genera Aspergillus and Penicillium), ergot alkaloids (Claviceps purpurea), including lysergic acid and agroclavine.

Protozoa, or protists, are the most primitively organized, single-celled eukaryotic animals. They are studied in sufficient detail in the course of medical biology. Protozoa are microscopic in size and can cause various parasitic diseases in humans, so they are the subject of study and medical microbiology. This chapter focuses on the features of the morphology of the pathogen and laboratory diagnosis of protozoal infections.

Protozoa are both heterotrophic and autotrophic unicellular organisms that can be mononuclear or multinuclear (sometimes only at certain stages of their life cycle) and in some cases form colonies. Currently, about 30,000 species of protozoa are known. They live wherever there is a humid environment. About 3,500 species of protozoa lead a parasitic lifestyle, living in various tissues and organs of humans, animals and plants, and are capable of causing serious diseases.

Protozoa are basically the same as any eukaryotic cell. Although they have various deviations in the morphology of cellular organelles, their shape and number are the same or close to those observed in multicellular cells. Only a few specialized protozoan organelles are not found in more highly developed organisms.

As in any animal cell, the essential and most important component of the protozoan cell is the nucleus. It is composed of the same components as the nuclei of cells of multicellular organisms, surrounded by a typical two-layer membrane penetrated by numerous pores. All vital organelles are concentrated in the cytoplasm. Usually, two layers are separated in the cytoplasm of protozoa: a thin outer layer - ectoplasm, more dense and homogeneous, and an inner, or endoplasm, which has a more liquid consistency. Often the most superficial layer of ectoplasm is even more dense and forms a peripheral film, or pellicle. It is a membrane thickened and complicated with additional structures, which gives it mechanical strength, allowing it to perform a protective function and give the cell a more or less permanent shape. In addition, some protozoa have paired fibrils and a mineral skeleton.

Protozoa move either with the help of pseudopodia - temporary outgrowths of the cytoplasm, or with the help of flagella or cilia. They reproduce sexually or asexually: both are based on nuclear fission. Mitosis is the basis of asexual reproduction; sexual reproduction is reduced to the fusion of two generative nuclei that have undergone reduction division and contain a haploid set of chromosomes.

Under unfavorable conditions, the protozoa stop feeding, lose their organelles, round out and become covered with a thick shell, which is accompanied by the attenuation of life processes: a cyst is formed. The process of encysting is a defensive reaction that has arisen in the course of evolution. It is cysts that play a large role in the spread of protozoal infections.

Until recently, protozoa were considered as one of the types of the animal world. Now the animal kingdom is divided into two sub-kingdoms: unicellular and multicellular. In turn, unicellular (protozoa) are divided into 5 independent types, differing in internal organization: sarcoflagellates (Sarcomastigophora), sporozoans (Sporozoa), cnidosporidia (Cnidosporidia), microsporidia (Microsporidia) and ciliated, or ciliates (Ciliophora). The term Protozoa means sub-kingdom. It should be emphasized that this classification is also far from perfect, since it does not fully take into account, for example, the nature of reproduction or structural features of the organelles of movement, which was taken into account in the previous classification, according to which the type of protozoa was divided into 4 classes (sporozoans, flagellates, sarcodes and ciliates). Apparently, as new data on protozoa are accumulated, their classification will change significantly in the future.

Toxoplasmosis is a chronic protozoal infection, manifested by lesions of the nervous system, liver, spleen, skeletal muscles and myocardium. The causative agent is Toxoplasma gondii. For the first time, the pathogen was isolated by S. Nicol and J1. Mansb (1908) in gundi rodents (Ctenodactylus gundi). T. gondii is an intracellular parasite 4-7 microns long, resembling an orange slice or an elongated onion [from the Greek. toxon, onion, + plasma, shaped]. According to Romanovsky-Gymsa, the cytoplasm of Toxoplasma is stained blue, the nucleus is red-violet. Infection of a person occurs through the alimentary route when oocysts or tissue cysts penetrate (when eating raw or half-cooked meat products, unwashed vegetables and fruits), less often through the skin (when cutting carcasses, working with laboratory material) or transplacental. The disease is ubiquitous, the infection rate of the population of different countries is 4-68%. The primary and primary hosts are domestic cats and other members of the feline family.

Intermediate hosts are humans, many wild and domestic animals and birds.

LIFE CYCLE

The life cycle consists of stages of sexual (gametogony) and asexual (schizogony, edodiogeny, sporogeny) reproduction. Sexually, toxoplasma reproduces in the body of cats; asexually - both in the main and intermediate hosts. In the body of any warm-blooded animal, Toxoplasma can reach the stage of tissue pseudocysts, in which cystozoites (merozbites) are formed asexually. Primary infection of felines occurs by eating the meat of intermediate hosts. Parasites enter the intestinal cells and turn into trophozoites, which reproduce asexually. Sexual reproduction of the parasite also occurs in the cells of the intestinal mucosa. Multiplied cystozoites destroy epithelial cells and penetrate into the underlying layers of the intestinal wall, where they are transformed into gametocytes. After the fusion of heterosexual gametocytes, a zygote-oocyst is formed - a rounded formation with a dense, colorless two-layer membrane with a diameter of 9-14 microns. From the body of the main hosts, oocysts are excreted with feces. They are well preserved in the soil, when they are swallowed, the intermediate hosts become infected. Sporozbites emerge from the oocysts and are

actively absorbed by macrophages, but phagocytosis is incomplete, due to which sporozoites disseminate through the lymph flow. In the cytoplasm of macrophages, the first stage of schizogony begins. At the later stages of schizogony, macrophages die, and the released parasites (tahizbites) invade the cells of the body (any nucleated cells are susceptible to invasion).

In the acute stage of infection, pseudocysts form in the form of accumulations of Toxoplasma in infected cells. When they are destroyed, parasites invade neighboring cells, and the cycle repeats. Parasitemia develops only in the acute stage.

In chronic processes, the pathogen forms true cysts with a dense shell (average size 100 microns). Each cyst contains more than a hundred parasites (bradysbites) arranged so densely that only nuclei are visible on the preparations. In the body, cysts persist for years and decades. This phase is the final one for the parasite in the body of all animals, except for the final host, in which the life cycle is completed.

TREATMENT AND PREVENTION

Patients with normal immune status and the absence of clinical manifestations do not require specific treatment. Patients with severe forms, eye lesions or immunodeficiencies, as well as pregnant women need a course of therapy. The drugs of choice are sulfonamides and pyrimethampine, used in combination. For the prevention of all forms of toxoplasmosis, it is important to follow the rules of personal hygiene and the rules for keeping cats. Especially careful precautions should be taken by pregnant women, patients with immune disorders and medical personnel in contact with infected material.

Giardiasis (syn.: giardiasis) is a protozoan infectious disease characterized by lesions of the upper small intestine (duodenitis) and gallbladder (cholecystitis). In most people, giardia infestation is asymptomatic or is accompanied only by intestinal dysfunction. The causative agent of the disease is Lamblia intestinalis (Giardia intestinalis) from the family Hexamitidae, class Zoomastigophora. The source of infection are sick people or parasite carriers. In the human body, Giardia multiply in large numbers. During the day, one person can excrete up to 18 billion cysts of this pathogen with feces. Giardiasis is found everywhere. L. intestinalis is found in 10-12% of adults and in 50-80% of preschool children. The mechanism of invasion is fecal-oral, the transmission factors are water, food, toys, household items, contaminated hands. Invasive only Giardia cysts, which are sufficiently stable in the external environment. The material for laboratory diagnostics is stool and duodenal contents obtained by probing, blood for serological reactions.

4. Illustrative material: multimedia projector (presentation)

5. Literature: Application №1

6. Security questions:

1. The difference between eukaryotic organisms and prokaryotes.
2. Biological features of fungi.
3. Biological features of protozoa

4. What applies to protozoal infection.
5. Name the life cycle of toxoplasma.
6. Name the test material for toxoplasmosis.
7. List the serological tests for the detection of toxoplasmosis.

Lecture №9

1. Topic: Causative agents of respiratory viral infections.

2. Objective: To explain to students the general characteristics, pathogenic factors and microbiological diagnosis of influenza, parainfluenza and coronavirus infection.

3. Abstracts of the lecture.

According to their frequency, acute respiratory infections occupy the first place among all diseases. Every person suffers from acute respiratory infections several times during his life. There are several reasons for this: a large number of viruses that cause acute respiratory infections (more than 130); lack of cross immunity between them; lack of effective vaccines against many of them; the simplest method of infection (airborne), causing the rapid spread of the pathogen, which, in the absence of immunity, can cause not only epidemics, but also pandemics. The causative agents of acute respiratory infections are the following viruses: orthomyxoviruses; paramyxoviruses; coronaviruses; reoviruses; picornaviruses; adenoviruses.

Influenza (grippus) is an acute viral disease of the respiratory tract with a pronounced epidemic distribution. Almost every influenza epidemic takes on the character of a real natural disaster, causing serious harm to the health of the population, and great economic damage to the country's economy. The infectious nature of influenza has been known since the time of Hippocrates (412 BC). The name of the disease "influenza" was given in the 18th century by the French physician F. Bruset. In Italy, this disease was called "influenza". At the end of World War I, humanity was gripped by the infamous Spanish flu epidemic. The origin of the Spanish flu is unknown. In Spain, in January 1918, the first printed reports of the epidemic appeared. The "Spanish flu" went around the world, infecting about 1.5 billion people (the population of the Earth in 1918 was about 2 billion people) and passing only a few islands lost in the ocean, such as St. Helena. It claimed 20 million human lives - more than the First World War.

At present, the group of influenza viruses is limited to three serological types - A, B and C. In 1933, English researchers W. Smith, C. Andrews, P. Laidlaw isolated the influenza virus from a sick person, initiating a new stage in the study of the etiological structure of influenza - one of the most massive infections on Earth.

In 1940, T. Francis isolated an influenza virus that differed significantly from previously isolated strains. It was proposed that the first strains isolated by V. Smith, K. Andrews and P. Laidlaw be called type A influenza virus, and the virus isolated by

T. Francis - type B. In 1947, R. Taylor isolated and described a new version of the influenza virus, called the C virus.

Type A virus causes influenza in humans, mammals, and birds, while type B and type C viruses cause influenza only in humans.

The first representatives of the adenovirus family were isolated in 1953 by W. Rowe and co-authors from the tonsils and adenoids of children, in connection with which they received this name. Adenoviruses lack a supercapsid. The virion has the shape of an icosahedron - a cubic type of symmetry, its diameter is 70-90 nm.

Currently, the global community is becoming increasingly concerned about the disease caused by the coronavirus.

Coronavirus appeared in China in the city of Wuhan, starting to spread there actively. Concern is the fact that the sick have high mortality rates, and there is no vaccine against the virus, there is no specific therapy as such.

Currently, rumors and speculation have begun to circulate that exaggerate the danger of a "new plague of the 21st century."

Coronavirus belongs to a family that includes many other viruses, both those that cause the common cold and severe acute respiratory syndrome.

The "crown" in the name appeared because the villi on the virus shell are shaped like a solar corona.

Coronaviruses (latt Coronaviridae) are a family of about 25 types of viruses united in 2 subfamilies that infect humans, cats, birds, dogs, cattle and pigs. These viruses were discovered in the 60s in people suffering from acute respiratory diseases. Structure. The genome is represented by (+) - single-stranded RNA. The nucleocapsid is surrounded by a protein membrane and a lipid-containing outer shell, from which spiny processes extend, resembling a crown. Cultivated in human embryonic tissue culture.

Coronaviruses multiply in the cytoplasm of infected cells, with daughter virions appearing 4–6 hours after infection.

In the external environment, coronaviruses are unstable; they are destroyed at a temperature of 56 ° C in 10-15 minutes.

Coronavirus infection is an acute viral disease with a primary lesion of the upper respiratory tract.

Etiology: RNA genomic virus of the Betacoronavirus genus of the Coronaviridae family.

Reservoir and source of infection: sick person or unknown animal.

Transmission mechanism: airborne (virus release when coughing, sneezing, talking), airborne, contact and fecal-oral (exact data is not available at the moment).

Ways and factors of transmission: air, food products, household items.

The period of contagiousness: the danger of infection is associated with contact with the respiratory secrets of the patient, in lower concentrations the virus is found in the feces, urine, saliva and lacrimal fluid of patients.

Incubation period: from 2 to 14 days, more often 2-7 days (there is no exact data at the moment).

Treatment: symptomatic.

Susceptibility and immunity: the natural susceptibility of people is high, all age groups of the population are sensitive to the pathogen (there are no exact data at the moment).

Clinical signs and diagnosis of 2019-nCoV infection: Main symptoms:

1) an increase in body temperature in> 90% of cases;

2) cough (dry or with a small amount of sputum) in 80% of cases;

3) feeling of tightness in the chest in > 20% of cases;

4) dyspnea in 15% of cases.

Diagnosis: detection of virus RNA by PCR

Case Definition: Patient with severe acute respiratory infection (SARI), with prior history of fever and cough requiring hospitalization, with no other cause (etiology)

WHEN:

visiting or living in China within 14 days before the onset of symptoms;

close physical contact with a patient who has a confirmed case of 2019-nCoV;

work or attend a health facility in a country where hospital-acquired cases of 2019-nCoV infection have been reported.

Complications

• severe pneumonia with respiratory failure requiring mechanical ventilation,

• acute respiratory distress syndrome (ARDS) with multiple organ failure,

• kidney failure requiring dialysis,

• debilitating coagulopathy,

• pericarditis.

Treatment is symptomatic, it is possible to use ribaverin interferons. Specific prophylaxis has not been developed.

General preventive measures

1. hand hygiene - mandatory washing with soap, it is additionally recommended to use a skin antiseptic (especially after contact with a person with signs of an acute respiratory disease or objects that this person has come into contact with);

2. use of personal protective equipment (use medical masks during the rise in the incidence of acute respiratory infections and in contact with a person who has signs of the disease);

3.regular cleaning at the place of residence and work using detergents and / or disinfectants;

4. frequent airing of the room;

5. if possible, avoid close contact with people who have signs of an infectious disease;

6. not be in areas with high crowding of people where a sick person may be;

7. increase alertness for food safety - try not to eat semi-finished meat products that are not subjected to sufficient heat treatment, unwashed vegetables and fruits, water from untested water sources, as well as drinks prepared on the basis of unsterilized water;

8.Despite the absence of any restrictions on travel to countries where patients with this infection have been identified, it is necessary to have increased alertness to the possibility of contracting a new type of coronavirus.

4. Illustrative material: multimedia projector (presentation)

5. Literature: Application №1

6. Security questions:

1. Characteristics of orthomyxoviruses.
2. Diagnosis, prevention and treatment of orthomyxoviruses.
3. Ecology and epidemiology of paramyxoviruses.

Lecture №10

1. Topic: Human immunodeficiency virus and oncogenic viruses.

2. Objective: To consider the microbiological diagnosis of human immunodeficiency virus and oncogenic viruses.

3. Abstracts of the lecture.

Oncogenic viruses are a group of unrelated viruses capable of causing a persistent infection in the cells of the human body, leading to their transformation (immortality). Transformed cells acquire new properties - a high rate of reproduction, the ability to uncontrolled unlimited division, lose sensitivity to signals that inhibit reproduction, including contact inhibition. There is a change in their morphology and metabolism.

DIAGNOSIS METHODS: Cytological method - detection of altered cells with signs of CPD (koilocytes).

Viroscopic method - detection of mature viral particles in infected cells. This method makes it possible to detect viruses only if they reproduce. Tumor cells contain defective viruses that are incapable of reproduction.

Virological method - not used due to the complexity of cultivating the virus.

Express diagnostic methods: immunochemical and molecular biological methods. Immunochemical studies. Detection of viral antigens in infected cells by IF method.

Molecular biological research. Detection of viral DNA in infected cells - the method of DNA probes (DNA hybridization in situ), PCR. These methods allow diagnosing latent infection and the presence of defective viruses.

Serodiagnostics. For the Objective of diagnosing RRC infection, antibodies to capsid proteins and viral oncogenes are detected.

Acquired Immune Deficiency Syndrome (AIDS), or AIDS, is a severe illness caused by the human immunodeficiency virus, HIV, which primarily affects the immune system. The disease is characterized by a long course, high mortality, is

transmitted naturally through sexual contact, as well as through blood during medical manipulations and a method for rapid epidemic spread. AIDS was first identified as a specific disease in 1982 in the USA. The causative agent of AIDS was discovered in 1983 independently by two scientists - the Frenchman L. Montagnier and the American R. Gallo. And received in 1986 the name HIV or HIV.

HIV is a relatively simple RNA-containing virus, has a spherical shape, about 100 nm in size. The nucleocapsid is formed by the proteins p24, p7 and p9. The p17 protein is adjacent to the inner surface of the membrane. Proteins p7, p9 are associated with genomic RNA, represented by two identical molecules. In total, 80 gp120 molecules are located on the surface of the virion in the form of peculiar spikes, each of which is associated with the intramembrane protein gp41. These proteins, together with the lipid bilayer, form the supercapsid of the virion. RNA-double-stranded, for the implementation of the process of reproduction of HIV has a reverse transcriptase or reverse transcriptase.

HIV has a number of surface and core antigens that determine its serological properties. Currently isolated HIV-1, HIV-2, HIV-3. In infected people, antibodies gp120 and gp 41 first appear, then p 24, which remain in the blood for a long time. HIV has a unique antigenic variability, which is hundreds and thousands of times greater than that of the influenza virus, due to the fact that its transcription rate is much higher than that of other viruses. This makes it difficult to diagnose and prevent HIV infection.

4. Illustrative material: multimedia projector (presentation)

5. Literature: Application №1

6. Security questions:

1. What are oncogenic viruses?
2. What is the difference between human immunodeficiency virus 1 and 2?
3. Can AIDS be eradicated?

Application №1

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