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SOME ASPECTS OF THE ORGANIZATION AND CONDUCT OF LABORATORY CLASSES IN MEDICAL INSTITUTIONS

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Abstract: This paper examines the organization and implementation of laboratory classes in medical educational institutions aimed at training specialists in the field of healthcare. The emphasis is on the importance of practical training of students, which allows developing the necessary skills and confidence in working with modern diagnostic equipment and medical technologies. The article discusses key aspects of organizing laboratory classes, including the choice of equipment, the development of curricula, and methods for assessing students' knowledge and skills. Attention is paid to the introduction of modern technologies and simulators, which contributes to a deeper understanding of the theoretical foundations and practical skills. Particular attention is paid to the interaction of students with teachers and specialists, as well as the organization of an interdisciplinary approach that promotes comprehensive assimilation of the material.
Keywords: Laboratory classes, medical educational institutions, practical training, diagnostic equipment, training of specialists, quality of education, professional competence, clinical skills.

Clinical laboratory diagnostics is a scientific medical discipline that originated at the junction of exact sciences (chemistry and physics) and biomedical specialties (biology and medicine). At the same time, clinical laboratory diagnostics is a specialized type of medical and preventive care for the population. The strategy and tactics of clinical and laboratory activities are determined by the national Service for Clinical Laboratory Diagnostics. Its main task is to help the attending physician in diagnosing the disease, treating patients, and implementing preventive measures. Doctors have been interested in laboratory diagnostic research of human biological fluids since before our era. Thus, indications for the study of the properties of urine were found in ancient Indian and ancient Chinese treatises written in the X–VI centuries BC. The ancient Egyptians and Greeks had a lot of experience and knowledge in the field of studying this human biological fluid, the famous physician Abu Ali ibn Sina (Avicenna) wrote about this in his treatises. However, the prerequisites for scientific laboratory diagnostics in the modern understanding of this term can be found only in the XV–XVI centuries in the works of Kuzantsis, Paracelsus, R. Boyle. M. V. Lomonosov, A. P. Lavoie zier and other scientists made a significant contribution to the formation of the foundations of individual sections of Clinical laboratory diagnostics in the XVIII–XIX centuries. The invention of the microscope and colorimeter, the discovery of the cell structure, the works of outstanding scientists A. P. Borodin, A. Ya. contributed to the further improvement of laboratory diagnostics.Danilevsky, I. A. Kassirsky. The guidelines on clinical laboratory diagnostics prepared by Russian (S. D. Balakhovsky, A. A. Pokrovsky, I. I. Ivanov, F. I. Komarov, I. M. Markelov, V. V. Menshikov, V. V. Dolgov, etc.) and Belarusian (M. F.Merezhinsky, L. S. Cherkasova, V. G. Kolb, E. P. Ivanov, A. A. Chirkin, V. S.

Kamyshnikov) by scientists.

The main objects of clinical and laboratory research are: the contents of vessels and cavities (blood and its morphological elements, plasma, serum, cerebrospinal fluid (CSF), transudates, exudates, intraarticular fluid, contents of the gastrointestinal tract), human body secretions (urine, feces, saliva, semen, condensate of exhaled moisture), tissue parenchymal organs, skin derivatives (nails, hair), etc. In recent years, red blood cells, which are commonly considered as a kind of tissue biopunctate, have attracted increasing attention from biochemists.

Fundamentals of laboratory examination of patients clinical laboratory diagnostics is a medical specialty, the subject of which is clinical laboratory research, i.e. the study of the composition of samples of biomaterials of patients with the task of detecting / measuring their endogenous or exogenous components, structurally or functionally reflecting the state and activity of organs, tissues, body systems, the defeat of which is possible with a suspected pathology. Specialists with higher medical education who have training in the field of clinical laboratory diagnostics are qualified as doctors of clinical laboratory diagnostics. Specialists with secondary medical education receive qualifications in the specialty "laboratory diagnostics" or "laboratory business". The term "clinical laboratory diagnostics" officially refers to a scientific medical specialty.

Modern clinical laboratory diagnostics performs a wide range of analyses.

Its structure usually corresponds to the tasks of medical institutions. General clinical laboratory diagnostics, which ensure the performance of the most common laboratory tests, express diagnostic laboratories designed for emergency analyses, as well as specialized clinical laboratory diagnostics, the main task of which is to perform complex analyzes, can be presented to medical and preventive institutions. The most common are general clinical laboratory diagnostics, which have a single structure. However, despite the unified structure, it is traditionally divided into smaller laboratories or departments: clinical laboratory (department), laboratory of clinical biochemistry (biochemical), immunological laboratory, cytological laboratory. The bacteriological (microbiological) laboratory, as a rule, is not included in the clinical laboratory diagnostics and functions as an independent unit of medical and preventive institutions, i.e. It belongs to specialized laboratories. clinical laboratory diagnostics should be placed in specially equipped rooms that fully comply with the requirements of the rules on device, operation and safety. clinical laboratory diagnostics of medical and preventive institutions acts as a diagnostic unit of medical and preventive institutions and has all the rights of an independent department, like all other medical and diagnostic departments of the institution.

Clinical laboratory diagnostics performs the following main tasks:

1) organization and conduct of laboratory tests: hematological, general clinical, cytological, biochemical, coagulological, immunological and bacteriological;

2) advisory assistance to doctors of medical departments in choosing the most informative laboratory tests for examining patients and evaluating the results of laboratory tests.

The clinical diagnostic laboratory is staffed by specialists of various skill levels who are responsible for conducting studies of incoming samples of biomaterial. Each clinical diagnostic laboratory is headed by a highly qualified doctor of clinical laboratory diagnostics - the head of the laboratory with relevant work experience. A doctor of clinical laboratory diagnostics can be a specialist who has received higher medical education in the specialty "Medicine", "Pediatrics", "Medical preventive medicine", "Dentistry", "Medical biochemistry", "Medical Biophysics", "Medical cybernetics" and has completed an internship or residency in the specialty "Clinical laboratory diagnostics".

The clinical diagnostic laboratory employs doctors of clinical laboratory diagnostics, biologists. They perform hematological, cytological, complex general clinical and immunological studies, a number of biochemical, coagulological, hormonal and serological analyses. Their responsibilities include monitoring the calibration of analyzers and conducting in-laboratory quality control. The average medical staff in the laboratory is represented by medical technologists; paramedics, laboratory assistants; medical laboratory technicians; laboratory assistants who receive biomaterial in the laboratory, prepare it for analysis and perform research. The main task of clinical laboratory diagnostics is to study a number of components contained in samples of biomaterial of the examined patients. The most common such components are the following:

- common chemicals (for example, glucose, bilirubin), the absolute or relative increase or decrease in the content of which in a certain biomaterial may have diagnostic significance;
- ordinary cells of biological fluids (for example, blood), the quantitative and some qualitative changes of which are important for the diagnosis of diseases; - unusual cells and non-cellular formations;
- viruses, bacteria, fungi, parasitic microorganisms;
- the chemical and cellular composition of biological fluids that are not formed (or are formed in small amounts) in a healthy person (for example, ascitic fluid, pleural effusion);
- ratios of homogeneous chemicals in different biological fluids (for example, creatinine in blood and urine during the Rehberg-Tareev test);
- toxic substances and medicines that can enter the patient's body.

The division of the clinical diagnostic laboratory into smaller laboratories or departments is due to the peculiarities of the analyzed biomaterial, research methods, equipment used, and the professional specialization of doctors of clinical laboratory diagnostics. The clinician should take into account these features of clinical laboratory diagnostics in his work. One of the most important tasks of laboratory diagnostics is the diagnosis of emergency conditions. Its task is to carry out research, the results of which are necessary for making a diagnosis in an emergency situation, to assess the severity of the patient's condition, and to correct substitution or drug therapy. The solution of this task in most medical and preventive institutions is entrusted to the laboratory of express diagnostics, which performs a limited list of diagnostic tests approved by the head of the medical and preventive institutions. An express analysis (urgent study) should be called a study that must be performed within a short time. Currently, it is generally accepted that the time from the delivery of biomaterial to the laboratory to the receipt of the research result should not exceed 40 minutes for specialized medical institutions and 1 hour for express laboratories of multidisciplinary medical institutions.

However, modern ideas about critical conditions and ways to correct them place higher demands on the time parameters for performing emergency laboratory tests. For the successful provision of intensive care, the time for performing laboratory tests for vital signs should not exceed 3-5 minutes. Such studies include the study of the acid-base state (CBS), the determination of hemoglobin, hematocrit, blood glucose, the study of electrolytes (potassium, sodium, calcium, chlorides), lactate.

The laboratory of rapid diagnostics performs research for patients in intensive care units and operating rooms (mainly laboratory tests to assess the main vital parameters of the patient), and in the evening for seriously ill patients in other departments of the hospital and admitted to the emergency department. The basis for applying for an emergency laboratory test is the expected change in treatment in case of accelerated receipt of the analysis result.

The clinical laboratory (department) performs hematological and general clinical analyses. Hematological analysis is used to diagnose and monitor diseases in which the number, size or structure of blood cells change. These include red blood cells (erythrocytes), white blood cells (leukocytes) and platelets. A general blood test is a complete count of all blood cells with the characteristics of their structure (including the leukocyte formula of the blood) - the most frequently prescribed laboratory analysis, the nature of changes in which indicates the presence of certain diseases in the patient. In fact, this is not a single test, but a set of tests, which will be discussed in more detail in the special chapters of this manual.

In modern clinical diagnostic laboratories, most of the hematological parameters are determined using automatic hematological analyzers. The use of the analyzer significantly reduces the volume of the bioassay for analysis, significantly reduces the time to obtain the results of the study and increases their accuracy. At the same time, some of the hematological parameters in the laboratory are obtained using a microscope. The microscope is still the main tool for analyzing bone marrow samples. Hematology studies play a crucial role in the diagnosis of malignant blood diseases (leukemia, myeloma) and anemia. Hematological indicators are equally important for assessing the body's response to many infectious and inflammatory diseases, allowing determining the severity of the course and effectiveness of the treatment by the dynamics of their changes. The results of most hematological analyses are usually ready within 4-6 hours, however, if necessary, some of them can be performed within 30-60 minutes at any time of the day. General clinical studies include the analysis of the physico-chemical characteristics and cellular composition of other (except blood) biological fluids of the patient's body - urine, sputum, fluid of serous spaces (for example, pleural), cerebrospinal fluid

(CSF) (cerebrospinal fluid), feces, secreted genitourinary organs, etc. Often, the results of the study of biological fluids play a crucial role in establishing the diagnosis of the patient. For example, the detection of a large number of white blood cells in the urine to establish the fact of infection of the urinary tract. However, the collection of each type of biomaterial to obtain reliable analysis results has its own characteristics that a doctor should know.

Cytological studies are aimed at studying the morphological characteristics of individual cells. As a rule, cells are scraped off the surface of such anatomical formations as the cervix, bronchi, mucous membrane of the nose, larynx, stomach. Cells for research can be collected using aspiration with a thin needle and syringe (for example, from the pleural cavity, from breast tumors). Smears on a slide are prepared from a suspension of cells in the laboratory, they are fixed, stained and analyzed under a microscope. Cytological studies are used in clinical practice mainly for the diagnosis of precancerous conditions and malignant tumors. A part of cytological studies serves as an obligatory component of screening programs (mass examination of the population using the most effective methods to detect a common disease). For example, the analysis of cervical smears is a mandatory study in screening women for cervical cancer.

The Laboratory of Clinical Biochemistry (biochemical) performs a wide range of analyses necessary for the diagnosis and evaluation of the effectiveness of treatment of many diseases and conditions. The main types of biomaterial that are analyzed in a biochemical laboratory are blood and urine. Blood consists of cells (erythrocytes, leukocytes and platelets) and a liquid part, which is a solution of many inorganic and organic substances. This is the liquid that is analyzed in most biochemical tests. Therefore, the first step after the delivery of blood samples to the laboratory for biochemical studies is the separation of the liquid part of the blood from the cells by centrifugation of the samples. The liquid part of the blood obtained after centrifugation may be plasma or serum. The difference between plasma and serum is determined by the type of test tube or branded device (for example, a vacuum cleaner) into which the nurse takes blood. If a test tube (vacuum cleaner) is used for this purpose without any additives, the blood coagulates and a serum is formed. If anticoagulants are added to the test tube (vacutainer), then the blood remains liquid (does not clot) and the liquid part obtained after centrifugation is called plasma. This is an important difference that a doctor and a nurse should understand when taking blood samples. Serum is examined in the laboratory to determine most biochemical parameters, but not for all (for example, plasma is needed to determine the adrenocorticotropic hormone [ACTH]). In addition, only plasma is needed to determine the indicators characterizing the state of the blood coagulation system. In a healthy person, the concentration of each component of the liquid part of the blood is within certain limits, which reflect the normal functioning of the main systems for maintaining homeostasis of the body, its cells and tissues. In diseases, there is often a violation of the balance of one or more biochemical parameters of the blood, the detection of which serves as the main principle of diagnosis during biochemical studies. The list of pathological conditions in which biochemical examination of blood and urine plays an important role is very wide and includes diseases of the heart, lungs, liver, kidneys, endocrine system and other systems. Some tumor cells release specific substances into the blood - tumor markers (OM), the detection of which by biochemical methods is used to monitor the course of the tumor process in patients. The biochemical laboratory performs tests to assess the condition of the blood coagulation system. These tests are indicated for the majority of patients who are referred to medical institutions for surgical treatment and are being treated in intensive care units. Many patients at risk for cardiovascular diseases take medications that slow blood clotting. Anticoagulant therapy must necessarily be accompanied by monitoring of the blood condition in order to prevent such a dangerous side effect of it as bleeding in time. Most biochemical analyses are performed in clinical laboratory diagnostics on automatic analyzers. The performance of autoanalysts in different laboratories may vary significantly. In small laboratories, autoanalysts are capable of testing 20-30 samples per hour for 10 biochemical parameters, in large ones - 200-400 samples per hour. The results of most biochemical tests are ready on the day of receipt of samples, when performing studies for patients with urgent conditions - within 1 hour. The immunological laboratory performs tests, the results of which are necessary for the diagnosis of various diseases and conditions based on immunological mechanisms. Such diseases include congenital (primary) and acquired (secondary) immunodeficiency. Immunodeficiency is based on the insufficiency of a certain link of the immune system. For example, the insufficiency of the phagocytosis system leads to

frequent recurrences of purulent infections, and the insufficiency of the cellular link of immunity (deficiency of helper T-lymphocytes) leads to the development of acquired immunodeficiency syndrome. It is not uncommon in clinical practice to encounter diseases in which the human body's immune system forms an immune response against its own tissues and cells.

The main consequence of such a violation of the immune response is the production of antibodies against normal cells. Such antibodies are called autoantibodies, and diseases that develop as a result of damage by such antibodies to healthy cells of the human body are autoimmune. The determination of auto-antibodies in the blood directed against certain cells and cellular structures plays a crucial role in the diagnosis of rheumatic diseases, a number of diseases of the thyroid gland, liver, kidneys, pernicious and hemolytic anemia. The most important part of the activity of the immunological laboratory is the determination of blood type and Rh factor in patients. Blood transfusion surgery has become such a common procedure that its dangers can easily be underestimated. At the same time, transfusion of donated blood, which is often necessary to save a patient's life, is associated with a significant risk for him. The correct determination of the blood type and Rh factor in both the donor and the patient in the laboratory, together with the competent actions of the nurse to identify the patient, the error-free filling in of the patient's passport data in the application form for research, significantly reduce this risk. When any infection enters the human body, the immune system produces antibodies against specific antigens (proteins) of the infectious agent (bacteria, viruses, protozoa, parasites, fungi).

An increase in the level of specific antibodies in the blood, which can be determined by serological methods, acts as an indicator of infection of a patient with one or another type of microorganism. Along with specific antibodies, serological research methods allow the detection of specific antigens in the blood, which also indicates the presence of a certain pathogen. Blood testing for the presence of specific antigens and antibodies is the most important method of diagnosing viral infections such as HIV, viral hepatitis B and C, as well as syphilis. The bacteriological (microbiological) laboratory employs bacteriological doctors and specialists with secondary specialized education - paramedics, laboratory assistants, technologists, laboratory assistants.

The main task of the bacteriological laboratory is to diagnose infectious diseases caused by bacteria (primarily) and fungi. The essence of the work of the bacteriological laboratory is the cultivation of bacteria on special enriched media and the subsequent determination (identification) of their species obtained from various biomaterials, including blood, urine, sputum, CSF, feces, secretions from the organs of the genitourinary system, discharge wounds and other infected areas of the body. One of the problems of bacteriological analysis is that many types of bacteria are opportunistic (symbiotes that live on human skin and mucous membranes without causing diseases). The task of a bacteriologist is that he can contaminate (infect) a sample with biological material during its receipt. Some human body fluids are normally sterile. These include blood, CSF and articular fluid, as well as punctates from the pleural and pericardial cavities. In this regard, the bacteria isolated from this biomaterial are always pathogenic. After identification of the pathogenic species or strain of the microorganism, it is necessary to establish its sensitivity to antibacterial agents. This information will help to prescribe the most effective treatment. In addition to diagnostic tasks, bacteriological laboratories and medical institutions perform an important function of infection control and prevention of nosocomial infections. The role of the laboratory in monitoring the condition of operating rooms, dressing rooms, and treatment rooms is no less significant. In addition to the clinical diagnostic laboratory, which performs laboratory tests for a specific medical and preventive institution, centralized clinical laboratory diagnostics are organized in our country, which are large-scale production facilities with a high level of automation and informatization, using high-performance laboratory analyzers and performing a wide range of laboratory tests for various medical and preventive institutions. Centralized clinical diagnostic laboratories ensure the availability of a wide range of modern, highly informative laboratory tests of high quality for doctors and various social strata of the country's population.

Thus, the clinical diagnostic laboratory provides reliable diagnostic information about the cellular, biochemical, and immune composition of samples of biological materials obtained from the patient, about the presence of microorganisms in them and about the compliance of indicators of this composition with the generally accepted norm or their comparison with similar indicators previously determined in the same person. The role of the bacteriological laboratory in the implementation of the principle of safety of medical

institutions for patients and medical personnel is enormous.

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