Federal State Budgetary Educational Institution of Higher Professional Education "North Ossetian State Medical Academy" of the Ministry of Health of the Russian Federation

Guidelines

"ONCOLOGY" IN CLINICAL RESIDENCE

Section 3. Diagnostic methods in oncology

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Teaching sections of the discipline "oncology" in clinical residency: guidelines for teachers Associate Professor S.M. Kozyreva - Vladikavkaz: SOGMA, 2016. - 92p. head department, d.m.s. Associate Professor Khasigov A.V., Art. laboratory assistant Sautieva M.G.

Methodological recommendations are intended to help teachers of medical universities in organizing the educational process at the departments of oncology of postgraduate medical education. The recommendations are drawn up in accordance with the work program of the discipline "Oncology" of the main professional educational program of postgraduate professional education for students in residency in the specialty "Oncology". The recommendations provide for theoretical and practical forms of organizing training for clinical residents, the sequence of classes to systematize knowledge on the clinical course, diagnosis, treatment, and prevention of malignant neoplasms.

SOGMA, 2016

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TOPIC 3. "DIAGNOSTICS IN ONCOLOGY".

1. Duration: 4 academic hours (1 academic hour - 45 minutes).
2. Venue: oncology dispensary.
3. The purpose of the lesson:
To comprehend the lecture material, to discuss in detail the possibilities of detecting malignant neoplasms of various localizations and the degree of their spread in the body. To study standard methods for examining patients with suspected malignant tumors of one or another localization.
To train residents in the main methods of diagnosing malignant tumors, the principles of clinical examination of patients, the choice of diagnostic methods for diagnosing a malignant neoplasm of one or another localization.
For this you need:
3.1. To systematize knowledge about the possibilities of detecting malignant neoplasms, methods of examining patients and their choice depending on the localization of the tumor.
3.2. To study the principles of using various diagnostic methods to establish the localization of a malignant neoplasm, the presence of metastatic lesions of the lymph nodes, distant organs to build a clinical diagnosis based on the classification of neoplasms.
3.3. To train residents in conducting examinations and drawing up a plan of diagnostic measures for patients with malignant neoplasms of various localizations.

3.4. The educational value of the topic: the analyzed material serves to develop the clinical skills of interns in examining patients with various localizations of malignant tumors.
3.5. The origins of the topic: the residents acquired basic knowledge at the departments: normal and pathological anatomy, pathological physiology, histology and cytology, surgery, therapy.
3.6. Output of the topic: the knowledge and skills acquired in the classroom are necessary for the development of diagnostic methods and the principles of constructing a plan for examining patients with malignant tumors of various localizations.

Motivation of the theme of the lesson. Establishing a diagnosis of a malignant neoplasm based on the TNM classification is necessary for the correct choice of treatment methods and the preparation of a treatment plan for the patient. The need to master the methods of differential diagnosis between a malignant tumor and a precancerous pathology of a particular organ.

Lesson plan.
1. Control test tasks.

2. Oral-speech survey on theoretical material (Diagnostic methods in oncology. Laboratory, radiation, endoscopic methods for diagnosing tumors. Radionuclide diagnostics. Tumor markers).

Test questions:
What are the features of history taking and physical examination in cancer patients?
Specify the goals of determining oncomarkers in oncology.
Name the main methods of X-ray diagnostics of oncological diseases.
What types of angiography do you know? What is the importance of angiography in oncological practice?
Describe the method of computed tomography. Advantages and disadvantages.
What is the method of magnetic resonance imaging based on? List the advantages and disadvantages of the method.
What are the physical foundations and applications of ultrasound in oncology?
What is the method of radionuclide diagnostics based on? List the types of radionuclide research.
List the main types of endoscopic examinations and their areas of application.
What tumor markers are used in the diagnosis and monitoring of malignant neoplasms of one or another localization?

3. Listening and discussion of abstracts:
Physical method in the diagnosis of malignant neoplasms
Radiation methods of diagnostics in oncology.
Endoscopic method in the diagnosis of malignant neoplasms.
Radionuclide diagnosis of malignant neoplasms.
Oncomarkers in the diagnosis of malignant neoplasms.

4. Practical work of residents:
4.1. Drawing up a plan of diagnostic measures for patients with malignant neoplasms of different localizations (16 nosological forms).
Training in the method of correctly drawing up a plan of diagnostic measures for patients with a malignant neoplasm, taking into account the extent of the spread of the malignant process.
Mastering the methodology for the correct preparation of a plan for diagnosing a malignant neoplasm, taking into account the degree of spread of the malignant process.
Mastering the methods of making a diagnosis according to the international TNM classification.

4.2. Solution of situational problems.

DIAGNOSTICS OF ONCOLOGICAL DISEASES
Basic principles of cancer diagnostics Diagnosis is the basis of medical art. There is a well-known proverb of German doctors “a diagnosis is made before treatment!”, The statement “who diagnoses well, treats well” is also true. Of course, some diseases can be cured by themselves or with the wrong treatment. But this does not apply to malignant neoplasms. With them, timely diagnosis is important, preferably in stages 1-2, when in most cases it is possible to carry out treatment with a favorable result. It should be noted the high prevalence and variety of oncological diseases. The principles of their diagnosis largely coincide with those that have developed in general medical

practice and, in particular, are set out by the staff of the Department of Hospital Therapy of the State Medical University in the book “The Algorithm of Clinical Thinking”, published in 2000 in Irkutsk under the editorship of Prof. T.P. gray. Stage 1 - a survey, collection of complaints, symptoms according to the principle "from top to toe" (M.Ya. Mudrov). Stage 2 - physical examination. Stage 3 - carrying out laboratory and instrumental methods. This takes into account the accepted standards of examination. In the case of an oncological disease, a morphological verification of the tumor is carried out and the stage is established according to the TNM system. The algorithm for diagnosing malignant neoplasms is presented in Table 3. In case of active detection - screening, or when the patient comes in after the onset of symptoms of the disease, anamnesis should be collected in detail, paying attention even to seemingly insignificant complaints. Perhaps asymptomatic even advanced cancer. Find out bad habits, such as smoking, its duration, intensity. Occupational hazards are noted: - exposure, contact with chemicals, etc. An anamnesis of life is collected, information about past and concomitant diseases, about the nature of the operations. Then they proceed to an objective study "from top to toe", to inspection, palpation, percussion.

Anamnesis and objective examination should be aimed at identifying tumor phenomena: obstruction, destruction, compression, intoxication, tumor-like formation. Obturation occurs when there is a violation of the patency of tubular organs and, as a symptom, often accompanies cancer of the esophagus, biliary tract, bronchi, etc. Destruction occurs when the tumor collapses and is manifested by bleeding. Compression is caused by the fact that the tumor tissue compresses the blood and lymphatic vessels, as well as nerve trunks, causing swelling of the limbs and pain. A mediastinal form of lung cancer is known, in which the clinical manifestation of a tumor that metastasizes to the mediastinum is edema and swelling of the veins of the head and neck. Intoxication with tumor decay products can cause anemia and fever. In 10-15% of oncological patients, it is not possible to identify the primary focus, and the disease manifests itself as metastases. Nevertheless, the first sign of a malignant neoplasm is most often 9 the tumor itself, determined either visually, or by palpation, or by instrumental research methods. Laboratory research. Tumor markers Changes in peripheral blood are more common in advanced stages of malignant tumors: anemia, ESR acceleration over 30 mm/h, leukopenia or leukocytosis, lymphopenia, thrombocytopenia or thrombocytosis. These changes are nonspecific, as well as biochemical changes. In pancreatic cancer, there is an increase in lipase and amylase, alkaline phosphatase. To date, there is no single laboratory test that indicates the presence of a malignant tumor in the body. At the same time, it has been established that malignant cells can secrete specific waste products into the liquid media of the body. In 1848, Bence-Jones described an unusual precipitation reaction in the urine of multiple myeloma patients. This was associated with the release of light chains by the tumor immunoglobulins. Bence-Jones myeloma proteins are specific monoclonal antibodies. In 1848, biological methods made it possible to detect pheochromocytoma by the level of catecholamines in the blood, and chorionepithelioma by the excretion of chorionic gonadotropin. Somewhat later, they learned to determine blood serotonin and its metabolites in urine in carcinoid syndrome. A great achievement was the discovery of oncofetal antigens by Soviet scientists G.I. Abelov and Yu.S. Tatarinov (1963, 1964). Tumor markers reflect various aspects of the functional activity of malignant cells. These are enzymes, tumor-associated antigens, ectopic hormones, some proteins, peptides and metabolites. There are more than 50 of them and the number continues to increase.

Tumor markers are a new and valuable tool in cancer diagnosis. However, it must be used skillfully and only in combination with traditional examination methods. Endoscopy Endoscopy is an internal examination of hollow organs or body cavities using endoscopes. Endoscopic diagnostics has a high resolution, small tumors can be detected by this method. Rigid devices are used for laryngoscopy, sigmoidoscopy. Flexible endoscopes based on fiber optics are less traumatic and allow examination of all parts of the food tube using fibroesophagoscopy, fibrogastroduodenoscopy, fibrocolonoscopy. Fibrobronchoscopy makes it possible to examine the tracheobronchial tree. With video endoscopy, the image is magnified many times, displayed on the monitor and available for archiving and additional computer processing. The material taken during endoscopic biopsy is sent for morphological examination. Endoscopic examination can be supplemented by the removal of tumor-like formations. So, with cystoscopy, which is used in the diagnosis of bladder tumors, the surgical endoscopic system allows for low-traumatic operations in this pathology. Thoracoscopy and laparoscopy can also be combined with treatment for small resectable neoplasms. Radiation diagnostics in oncology 12 Diagnosis of malignant neoplasms remains one of the most urgent tasks of modern medicine. The choice of the most effective diagnostic method is often difficult and controversial. Many methods for obtaining a diagnostic image of the affected organs have been introduced into oncological practice. Methods of medical imaging (radiation diagnostics), despite the different ways of obtaining an image, reflect the macrostructure (sometimes microstructure) and anatomical and topographic features. The combined analysis of their data makes it possible to increase the sensitivity and specificity of each of them.

In the oncology clinic, various methods of radiation diagnostics are used. All radiation used in medical radiology is divided into two groups: non-ionizing and ionizing. The main methods of radiation diagnostics include: In vivo studies - X-ray (including computed tomography) - radionuclide (including single photon and positron emission tomography) - ultrasound - magnetic resonance imaging (tomography) - medical thermography The last three methods using non-ionizing radiation sources. In Vitro Studies - Magnetic Resonance Spectroscopy - Activation Analysis - Radioimmunoassay Conventional radiography remains the main research method. Improved X-ray machines, devices with digital image processing have reduced the radiation dose by an order of magnitude, increasing the quality of the image, which has become possible to be subjected to computer processing. Plain radiography is performed for all patients with suspected oncological pathology. Computed tomography (CT) occupies a special place among radiological research methods. With the help of CT, an image of the transverse sections of the human body is obtained, which makes it possible to judge the topography of organs, the localization, nature and extent of the pathological formation, its relationship with the surrounding tissues, and to obtain a three-dimensional (volumetric) orientation of the pathological process. CT has improved accuracy and diagnostic certainty, improved radiotherapy planning, and more effectively accompanied surgical and interventional procedures.
A special place is given to the role of CT in the study of organ and non-organ benign and malignant tumors. Densitometric assessment of the optical density of volumetric formations and the different ability to accumulate a contrast agent in tumor formations allows, in many cases, to determine their organ and tissue affiliation. CT makes it possible to determine the features of the X-ray picture of tumor formations at different stages of development, during treatment (radiation and chemotherapy). Radionuclide research methods in oncology Unlike most diagnostic methods used in oncology,

radionuclide (nuclear medicine) methods allow us to evaluate not only structural changes in organs, but also metabolic disorders in tumors and surrounding tissues. These methods play an important role in assessing the functional state of organs and systems in patients with neoplasms. Radionuclide methods are not limited to tumor detection. Radiopharmaceuticals (RFP) are used in an already established tumor to determine the extent of the malignant process - the presence of regional and distant metastases. In unclear cases, they provide assistance in the differential diagnosis of a tumor and other pathological processes. For the 13th diagnostic study, it is recommended to use the most sensitive methods at the first stage, and the most specific ones at the second. Various radiopharmaceuticals emitting beta and gamma radiation are used to diagnose tumors. They are conditionally divided into the following groups:

1. Radiopharmaceuticals that can accumulate in the tissues surrounding the tumor (organotropic): - in intact tissues, in tissues subject to specific changes from the side of the tumor 2. Radiopharmaceuticals that are tropic to the membranes of tumor cells: cellular reception 3. Radiopharmaceuticals penetrating into tumor cells: - specific, non-specific. In group 1, radiopharmaceuticals that are tropic to one or another tissue of the body accumulate in it, and the presence of a tumor is detected as a focus of reduced accumulation. For example, gold-198 or technetium colloid accumulate in Kupffer cells of the liver, and primary liver tumors or metastases in it look like “accumulation defects” (“cold foci”) in it. Iodine-123 and iodine-131, technetium-pertechnetate are used in the diagnosis of nodular formations and tumors of the thyroid gland. The disadvantage of this technique is its low specificity. Radiopharmaceuticals can be hyperfixed in areas of tissue surrounding the neoplasm. For example, tissue areas around a bone tumor react with osteoblastic activity and allow visualization of bone metastases and primary tumors at the earliest stages, when they cannot yet be detected by X-ray methods. In the 2nd group of radiopharmaceuticals, tropic to the membranes of tumor cells by the “antigen-antibody” mechanism, there is a reaction of labeled monoclonal antibodies with antigens of tumor cell membranes. The reaction has a high oncospecificity. Of the radiopharmaceuticals that are tropic to tumor cell membranes by the mechanism of cell reception, somastatin analogues are used in the diagnosis of neuroendocrine tumors (carcinoid, pheochromocytoma, melanoma), small cell lung cancer, CNS neoplasms, and lymphomas. In the 3rd group, specific radiopharmaceuticals penetrating into tumors include iodine isotopes -123 and 131, which are used to diagnose differentiated thyroid tumors, their metastases. Iodine-123 - metaiodine - benzyl - guanidine (iodine-123 - MIBG) is highly effective in detecting neuroendocrine tumors. Non-specific radiopharmaceuticals that penetrate tumor cells (gallium citrate - 67) have been used for many years to diagnose lymphomas and small cell lung cancer, thallium-201 and 199 isotopes have been used to diagnose bronchial neoplasms, lymphomas, thyroid cancer, bone tumors, brain. There are various methods of radionuclide detection of tumors. Radiometry in oncological practice is used in the diagnosis of pigmented neoplasms. Phosphorus-32 is used, which is a pure beta emitter. The percentage of its accumulation in a symmetrical healthy area and in the neoplasm area is determined. A sharp increase in the concentration of phosphorus indicates a malignant nature of the tumor. Scanning - obtaining an image of an organ using radiopharmaceuticals introduced into the body. A moving collimated detector is located above the organ under study, which collects information on gamma radiation and captures it in the form of an image of the organ. The scanogram determines the shape, size, topography,

functional activity of the organ. The study takes considerable time due to the small size of the detector, which is forced to move over the patient in order to obtain a complete image of the organ. An image can also be obtained using the GAMMA-CAMERA apparatus, in which the collimated detector has a large diameter and the entire organ under study falls into its field of view at once. This study is called gamma scintigraphy. It can be used to obtain a static and dynamic functional-anatomical image, i.e., this method allows you to study the fast-running processes 14 of the distribution of radiopharmaceuticals introduced into the body. Radionuclide emission tomography is also widely used. Like any tomography, it provides a layer-by-layer study of the organ.

2. Radionuclide tomographs cannot compete with morphological tomography in identifying anatomical details, but they have an important ability to capture the distribution of radiopharmaceuticals in different parts of the organ under study, which reflects its functional state. That is, radionuclide tomography is rightfully called functional tomography. Its role is significant in cases where functional disorders precede obvious anatomical changes. According to the nature of the radionuclide radiation used, all emission tomographs are divided into single-photon (SET) and positron (PET) - two-photon. During SP in a gamma camera, the detector moves around the part of the body being examined. Gamma-emitting radiopharmaceuticals are used, which are selected depending on the objectives of the study. PET uses short-lived radionuclides that emit positrons. The positron, flying out of the atom, interacts with an electron in the surrounding tissue; as a result of the meeting, both particles disappear and two gamma quanta (annihilation) are formed instead of them. In PET, these gamma quanta are registered using several rings of detectors surrounding the patient. Only those gamma quanta that were formed simultaneously are registered. PET provides unique diagnostic information. It is currently used mainly in three areas of medicine: oncology, cardiology and neurology. Similar to CT and MRI, a tomography technique is used, which allows obtaining sections in various planes. Using PET, it is possible to obtain functional images that reflect the vital processes of organs and tissues of the human body at the molecular level. The labeled substance is selected depending on the function of the body, which needs to be monitored. For example, if you need to determine how fast cells build themselves (tumor!), then choose the amino acid C-11-methionine, (necessary in the construction of a protein molecule). The screen will show bright areas in the places where these intensively working cells are located. In these cases, a glucose analogue, fluorodeoxyglucose, with a half-life of 110 minutes, is used. The uniqueness of this radionuclide study lies in the fact that it is possible to obtain accurate information about the metabolism of the positron emitter in the body in any limited amount of tissue. This is very important, since very often changes at the functional cellular level precede morphological changes. Therefore, many diseases are diagnosed using PET much earlier than CT and MRI, before the appearance of structural changes, which significantly improves the prognosis. When diagnosing oncological diseases, it becomes possible to non-invasively determine the degree of malignancy of the tumor, determine the damage to the lymph nodes, distant metastases, relapses, and conduct differential diagnosis between cicatricial changes and tumor recurrence. PET allows you to monitor the effectiveness of treatment - to determine the response of the tumor to radiation therapy, chemotherapy treatment. With the effectiveness of treatment, the consumption of glucose by tumor cells decreases, the level of accumulation of C-11-methionine decreases, the number and size of metastases decrease. Today, PET is one of the most informative

methods used in nuclear medicine. Radiocompetitive analysis is used to diagnose malignant tumors. In the patient's blood, they search for substances secreted by the tumor - tumor markers. By their concentration, it is possible to judge the presence of a tumor process and clarify the prognosis of the disease. A high concentration of tumor markers in the blood is an unfavorable prognostic factor. A promising method is immunoscintigraphy, with which it is possible to locate the tumor using labeled anti-marker antibodies. Saturate the tumor with a radionuclide and visualize it on topograms.

3. This technique is used to diagnose relapses of a treated malignant tumor and detect its metastases. Currently used for colorectal cancer, breast tumors. Within the framework of radiation diagnostics, a new direction is emerging - clinical radiological biochemistry. It includes such methods as X-ray spectral analysis - the study of the chemical composition of biological samples by their X-ray spectra; X-ray diffraction analysis of the distribution of scattered rays in space and their intensity study the structure of biological objects; activation analysis - determination of the concentration of stable nuclides in biological samples and throughout the body. All these methods are promising in the diagnosis at early stages of oncological diseases. The magnetic resonance method of research is based on the phenomenon of nuclear magnetic resonance. Direct analysis of electromagnetic signals of relaxing protons is used for spectrography and magnetic resonance imaging (MRI). MR - spectrography. The essence of the method is as follows: the studied sample of tissue or liquid is placed in a stable magnetic field. The sample is exposed to pulsed radio frequency oscillations. By changing the magnetic field voltage, resonant conditions are created for different elements in the magnetic resonance spectrum. The received MR signals are analyzed. Their intensity and density depend on the density of protons and the relaxation time, which makes it possible to judge the chemical and spatial structure of the substance. According to the type of MR spectrum, mature and immature tumor cells, oxygenated and hypoxic tissues, membrane permeability are differentiated, i.e., information important for biology and medicine is obtained. Magnetic resonance imaging allows you to get an image of any layers of the human body in any section. MR tomograms represent the spatial distribution of molecules containing a hydrogen atom. Better than computed tomograms, they reflect soft tissues: muscles, fat, cartilage, blood vessels. Since the bone tissue contains a small amount of water, the bone does not create a shielding effect and does not interfere with the image of the spinal cord, intervertebral discs. This method has a high resolution. High natural tissue contrast on MR images, in most cases, does not require the use of contrast agents. There is no radiation exposure to the patient. The disadvantages of the method include: the duration of the study, the need for complete immobility of the patient. Indications for MRI studies in oncological practice are: suspicions of primary and metastatic tumors of the brain and spinal cord, tumors of soft tissues, larynx, the presence of space-occupying mediastinal formations, suspicions of the vascular nature of the formation, suspicions or the presence of tumors in the abdominal cavity, retroperitoneal space, small pelvis. In case of a suspected tumor, sometimes a native study is supplemented with contrast enhancement. Indications for the study of large joints is the suspicion of a tumor lesion with intra-articular spread. Thermography is a method of recording the natural thermal radiation of the human body in the invisible infrared region of the electromagnetic spectrum. Thermography determines the characteristic "thermal" picture of all areas of the body. In a healthy person, it is relatively constant, but in pathological conditions it

changes. In oncological practice, this method is more often used in the study of the mammary glands. A malignant tumor is characterized by a zone of intense hyperthermia (2-2.5 degrees higher than the temperature of the symmetrical region). The structure of the area of hyperthermia is homogeneous, the contours are relatively clear, dilated vessels are visible. For the effectiveness of the study, a method of so-called active thermography is used. It is carried out after physico-chemical influences, to which normal and tumor tissues react differently. With a hyperglycemic test, which is based on intravenous administration of glucose into the body, with a malignant tumor, the temperature rises in the affected area 16 by 0.7-3.0 degrees. The temperature of the tumor also rises under conditions of hyperbaric oxygenation in an oxygen treatment pressure chamber. Interventional radiology At the junction of radiology and surgery, a new clinical area has emerged - interventional radiology. Its essence is a combination of diagnostic X-ray and therapeutic measures in one procedure. First, the nature and extent of the lesions are determined using x-ray studies, and then the necessary medical manipulations are performed. These procedures are performed by an X-ray surgeon in an X-ray room equipped for surgical interventions and angiographic studies. Medical procedures, as a rule, are carried out percutaneously with the help of special instruments (needles, catheters, conductors, stylets, etc.). The most widely used X-ray endovascular interventions. In oncological practice, X-ray endovascular occlusion (transcatheter occlusion of a vessel) is used, for example, to stop pulmonary, gastric, and intestinal bleeding. It is also used in some surgical interventions (for kidney tumors, this method facilitates the removal of the neoplasm). The X-ray endovascular method has become widespread for the selective administration of radioactive drugs, during tumor chemotherapy, since the local effect of drugs is often more effective than intramuscular or intravenous. Extravasal (extravascular) manipulations are also carried out. Under the control of X-ray television, bronchial catheterization is performed to obtain biopsy material. Under X-ray control, in particular CT, perform percutaneous transthoracic punctures of intrapulmonary or mediastinal formations. An aspiration biopsy is performed to determine the nature of intrathoracic and abdominal formations, infiltrates, which saves patients from trial thoracotomy or laparotomy. It is also carried out to identify non-palpable formations in the mammary gland. Punctures are performed using X-ray television transillumination, including CT, or using ultrasound. For targeted biopsy, various methods of radiation diagnostics can be used. Each method has its own advantages and limitations. The choice of biopsy technique depends on the individual case and indications. For example, the cross section obtained with CT makes it possible to accurately localize anatomical structures and neoplasms, which makes it possible to use CT for organ puncture. Most often, CT is used in the following cases: biopsy of formations, the visualization of which is difficult with other research methods; formations with a diameter of less than 3 cm, deeply located formations or located close to the vessels, intestine, bones; drainage of abdominal abscesses; re-biopsy in case of unsuccessful attempts to use other methods. From all of the above, it follows that the use of radiation methods for examining individual organs and systems should be used purposefully, taking into account clinical problems and the nature of the disease. Ultrasound examinations Today it is difficult to imagine the diagnosis of neoplasms without an ultrasound method, and this despite the fact that ultrasound examination (sonography) - the youngest diagnostic technology (known since the early 50s of the last century). Based on the acoustic phenomena of radiation, absorption and

reflection of ultrasonic waves in the tissues of a living organism, multiplied by the rapid progress of digital information technologies, ultrasound diagnostics today is one of the most high-tech diagnostic areas. Over the past 50 years, the use of ultrasound has changed beyond recognition - from a primitive analogue of an echo sounder, capable of displaying only a frequency-amplitude curve on an oscilloscope, to a realistic three-dimensional real-time display with pseudo-colorization. 17 It is no secret that clinical oncology is the most rewarding field for the application and development of various diagnostic technologies, including ultrasound, primarily due to the high percentage of morphological verification of the diagnosis, which is an essential requirement when developing treatment tactics for a cancer patient. What contributes to the development of ultrasound diagnostic method? Compared to competitive methods (X-ray, CT and MRI, endoscopy), ultrasound examination remains the safest - there is no radiation exposure for the doctor and the patient, undemanding when choosing a room, the availability of special equipment or special power supply, the study does not require special preparation, there are no restrictions on sides of the patient by body weight or dimensions, etc. A very significant advantage is the possibility of polypositional scanning, obtaining an image in real time, which allows you to observe the movement of organs - during breathing, the peristalsis of hollow organs. At the same time, the indicators of the diagnostic efficiency of ultrasound are not only not inferior, but also superior in such types of pathology as, for example, breast cysts, nodular formations of the thyroid gland, etc. Prevalence estimate oncological process is most accurate precisely due to intracavitary or intraoperative ultrasound examination. I would especially like to emphasize that, despite the competition with traditional diagnostic methods, the ultrasound method cannot be opposed to them as an independent one; in any case, ultrasound should be considered as complementary, sometimes making decisive additions. At the same time, the presence of barriers to traditional ultrasound (gas, bone and fibrous structures) makes echography of a tumor of the chest, gastrointestinal tract, bones, brain and spinal cord inaccessible. However, recent advances in technology have also led to success in these areas of ultrasound applications. The gastrointestinal tract is examined using endoscopic equipment with a built-in ultrasound emitter. In a similar way, it became possible to examine the bronchial tree. With the help of laparoscopic technique with ultrasound equipment, both the organs of the abdominal cavity and the organs of the chest are examined. It is impossible to ignore the techniques based on the well-known effect of the frequency shift of the reflected signal from a moving object. The undeniable advantage of these techniques is the most adequate real-time display of blood flow parameters in organs and tissues, which allows you to more accurately differentiate the tissue and fluid nature of formations, identify the vascular nature of the lesion, which is very important for the safety of invasive manipulations. In addition, the use of Doppler imaging modes improves the visualization of the needle in tissues when performing a needle biopsy. Despite such a high potential, the ultrasonic method is one of the most operator-dependent, i.e. From the experience of the researcher, from the adequacy of the task, from taking into account additional information and some other factors, depends on how adequate the result of the study will be.

In practice, we constantly have to deal with situations where the capabilities of the method are overestimated - for example, the appointment of ultrasound as a screening method for breast cancer is a waste of precious time and other resources. There are no less examples when the possibilities of the method are underestimated.

In hospitals where conservative radiologists are in a strong position, for example, clinicians do not take into account ultrasound data indicating the presence of fluid accumulation in the pleural cavity only on the basis that radiographic data do not confirm this. It should be emphasized, however, that the set of ultrasound signs of pathological changes is not so diverse that one can speak of a high specificity of the method. Many pathological conditions can have a very similar ultrasound picture. 18 What are the main tasks that the ultrasound method has to solve in oncological practice? First of all, of course, this is the detection of neoplasms of organ and extraorgan affiliation. This is ensured by the resolution of the device, the experience of the researcher doctor, his knowledge of normal and ultrasound anatomy. The second task is to assess the prevalence of the pathological process or ultrasonic topometry, which determines the stage of the disease and influences the treatment plan. To solve this problem, sometimes traditional ultrasound is not enough. The most accurate information can be obtained using intracavitary access - transvaginal for gynecological pathology, transrectal for pathology of the rectum, adrectal tissue, prostate and bladder, endoultrasound with transesophageal, transgastric, transbronchial accesses, laparoscopic and classical intraoperative ultrasound, incl. with trepanation of the skull. The third task is to ensure that the morphological substrate of the disease is obtained. In other words, ultrasonic navigation when performing diagnostic and treatment-diagnostic manipulations. It should be emphasized that the ultrasonic method has practically no competitors in this component.

Due to its safety, unpretentiousness, accessibility, the possibility of polypositional scanning and at the same time high accuracy, ultrasonic navigation "wins" over the classical methods of visual control. If we consider the possibilities of the method in oncological practice, it turns out that the sensitivity of ultrasound in detecting focal formations in one organ can differ significantly from that in another organ. Moreover, depending on the acoustic characteristics of formations, the specificity of the method may differ significantly. And the possibility of obtaining a morphological substrate under the control of an ultrasound image does vary depending on various factors. The practical experience of the clinic of the regional oncological dispensary allows us to draw some conclusions on the diagnostic effectiveness of the ultrasound method in various situations. Thus, when examining the abdominal organs, the task is usually to search for neoplasms in the parenchymal organs, retroperitoneal space, and fluid accumulations. The high position of the liver, pronounced pneumatization of the intestine, inadequate preparation of the patient sharply reduce the overall high sensitivity of ultrasound in detecting focal liver changes. Particularly difficult are formations that are identical in acoustic "density" (isoechogenic structure) with the surrounding tissue. In such a situation, the task can be facilitated by the use of the so-called tissue harmonic mode, a technology for digital processing of the reflected acoustic signal that separates and amplifies the re-reflected signal. In addition, examination of suspicious areas of the parenchyma in the mode of color Doppler mapping (CDC) and power Doppler (ED). Lesions that have a relatively higher reflectivity (increased echogenicity) cause even greater difficulties in interpretation, and thus some benign conditions - hemangiomas, as well as malignant ones - metastases, can appear, in which the characteristic "rim" is not immediately differentiated. Therefore, you cannot fully rely on traditional ultrasound examination. No wonder CT is preferred to screen for liver metastases. But even CT is inferior to the possibilities of intraoperative ultrasound, which makes it possible to differentiate small metastases that were not

detected by transabdominal examination and CT. According to this example, it can be said that ultrasound diagnostics in general has a relatively high sensitivity in the diagnosis of focal liver lesions, while the probability of a false negative result will be relatively high, but the probability of a false positive response will also be low. With a lesion of the pancreas, seeing the primary focus is even a big problem, because. patient preparation, the presence of other artefacts, and the experience of the examiner have an even stronger influence on the ability to visualize. 19 The presence of signs of biliary hypertension, cystic hypertension, ectasia of the Wirsung duct indirectly suggest the presence of a mass formation in the head of the gland or a tumor of the obstructive ductus. The most adequate methods for diagnosing pancreatic tumors are CT and transgastric endoultrasound, the latter of which provides the most comprehensive information. Retroperitoneal lymphadenopathy, detected by ultrasound, has a high diagnostic value, because lymph nodes without a malignant lesion are practically not visualized by ultrasound. Morphological methods in oncology Pathomorphology is the cornerstone in oncology. Special treatment of an oncological patient usually begins after the morphological verification of the tumor process. The material provided for morphological verification is examined by cytologists and pathologists. Cytology One of the simple and affordable methods of morphological diagnosis of tumors is a cytological study. Its main goal is the early diagnosis of tumors and precancerous processes. According to the methods of obtaining material, it is divided into exfoliative and puncture cytology. With exfoliative cytology, fluids are examined - transudates, exudates, washings, secretions - sputum, urine, smears from the cervix, smears from the surface of the tumor, discharge from fistulas. The method of puncture cytology is used to study the material obtained by fine-needle aspiration of tumor formations of any localization, including under the control of ultrasound, X-ray, computed tomography. The thickness of the needle, which is recommended to perform the study - 0.7 mm., The international designation of this diameter is 22 gauge (G). Puncture lymph nodes, superficially located tumors, glands - salivary, milk, thyroid. Under the control of ultrasound and CT, punctures of the liver, kidneys, pancreas, thymus, bone and soft tissue tumors, tumors of the mediastinum, retroperitoneal space, brain and spinal cord, and even the eye are performed. A significant amount of research in clinical cytology consists of smears-imprints from pieces obtained during a columnar biopsy, smears-imprints from surgical and biopsy materials, smears from aspirates and brush scrapings obtained during endoscopic studies (esophagus, stomach, intestines, trachea, bronchi and lungs). The resulting material is applied to a slide, dried in air, delivered to the cytology laboratory, where it is stained with various dyes (according to Romanovsky, hematoxylin-eosin). The advantages of cytological examination are accessibility, low trauma in obtaining the material, the ability to examine loose material of small volume, the possibility of multiple repeated studies, the simplicity and speed of preparing preparations, and low cost. For a cytological study, a significantly smaller amount of material is needed, from which a preparation can be prepared without lengthy preliminary preparation - in comparison with histological studies. However, the method has its limits. Its limitations are less diagnostic information due to the lack of spatial relationships of tissue components compared to histological examination. The current level of cytological diagnostics in many cases makes it possible to determine the nature of the pathological process, the presence of inflammation, reactive changes, assess the degree of proliferation, identify a group of dysplasias, diagnose cancer in the initial stages, in the preclinical period. In

addition, the cytological method allows in most cases to establish the tissue affiliation and the degree of differentiation of the tumor. It can be used to assess the extent of the tumor, to determine the presence of a recurrence or metastatic lesion, in some cases to establish the source of metastasis. It makes it possible to assess the sensitivity of a tumor to therapeutic effects (chemoradiation) and is used to dynamically monitor the results of treatment.

Cytological examination is widely used during surgical interventions to determine the nature of the pathological process, the presence of metastases, tumor growth into neighboring organs and tissues, to determine the presence / absence of tumor cells at the edges of the resected material. The cytological method is especially widely used for mass preventive examinations of the population, in particular for gynecological screening of cervical cancer. Cytological examination of smears from the cervix 10 times increases the detection of tumors compared with a conventional gynecological examination. Using the cytological method, it is possible to substantiate the formation of high-risk groups for cervical cancer. This method is highly effective in screening for nodular thyroid neoplasms to select patients for surgical treatment. The criterion for the accuracy of the cytological response is histological examination. The coincidence of cytological conclusions, with subsequent histological ones, is 87-95% for cancers, 79-87% for sarcomas, and 88% for benign processes. Parallel cytological and histological studies are very valuable. This combination significantly increases the level of diagnostics. When conducting cytological studies, it is important to obtain a full-fledged adequate material. When obtaining material for cytological examination, a number of conditions must be observed. For fine needle aspiration, the needle and syringe must be dry. Preliminary anesthesia is not recommended. The peripheral areas of neoplasms should be punctured. It is necessary to avoid puncture of softened and dense areas of tumor-like formations. When puncturing richly vascularized formations, it is recommended to use a needle with a mandrel (thyroid gland, vascular tumors, bones). The mandrin must be removed after making sure that the needle is in the area from which the material is supposed to be obtained. Puncture is best done under the control of X-ray, ultrasound, computer tomograph. In the manufacture of preparations of discharge from various organs, a drop of discharge is applied to the glass and a smear is prepared. Imprints from the mucous membranes and skin can be made directly on the glass or scraped with brushes, spatulas, swabs. Upon receipt of the liquid, it is immediately delivered to the laboratory for centrifugation and preparation of smears from the sediment. If the delivery of the material to the cytological laboratory is not carried out immediately, a few crystals of sodium citrate must be added to the liquid container to prevent clotting. When receiving a large amount of liquid, it is better to study the first and last portions. When preparing prints from a biopsy section or a piece of surgically removed tissue, it is recommended to touch the cut surface to the glass, after removing the blood on filter paper, and only then apply the prints. In addition, it is possible to prepare a scraping from the incision surface. The choice of method for obtaining material is determined by the possibility of conducting instrumental studies. It is desirable to investigate the material obtained by all methods, because the efficiency of cytological examination in this case is 100%. On cytological smears, with appropriate preparation, it is possible to perform cytochemical studies (to detect glycogen, fat, iron, lipids), immunocytochemical studies (hormone receptors and growth factors, determination of tumor histogenesis and the source of metastasis). Analyzing the image of cytological smears on a computer, it is possible

to measure many parameters (morphometry), revealing various patterns, which objectifies the study. 21 Techniques for electron microscopic and molecular genetic studies on cytological preparations have been developed. In recent years, such a section of clinical cytology has been developing, which is designated by the term, which is translated into Russian as "liquid cytology", when the material obtained for the study is placed in a special liquid medium and a cytological preparation is prepared using a cytocentrifuge. Liquid technologies for the preparation of drugs have significant advantages and avoid contamination with blood and inflammatory elements. The obtained preparations contain the studied cells in the form of a "monolayer", which facilitates the viewing of cytological smears and reduces the number of false negative results. Monolayer preparations with well-preserved cells in a certain fixed area allow the use of modern computer technologies for image analysis and processing, and morphometry. The consumption of expensive reagents is reduced, which is especially important for immunocytochemical and molecular genetic studies.

It is very important to remember that the material fixed only with neutral formalin is suitable for immunophenotyping, the fixation period should not be less than 10 hours, and not more than 24 hours. If these rules are violated (operation on Friday, delivery to PJSC on Monday), artifacts are possible that do not allow revealing the true histogenesis of the tumor. In Russia, the widespread practical implementation of IFT methods began in 2000. One of the advantages of IPT research is the possibility of a retrospective study of archival material, i.e. paraffin blocks, even many years old, can be used for research. Electron microscopy Allows you to examine the ultrastructure of cells, determine the nature of their origin (histogenesis). So, in tumor cells of unclear, controversial histogenesis, one can consider such structures as neurosecretory granules in carcinoids, synaptic vesicles of neurogenic tumors, premelanosomes of unpigmented melanomas, lipid drops in dedifferentiated liposarcomas, accumulations of glycogen in Ewing's sarcomas, filamentous substance of rhabdoid tumors, sarcomeric formations in rhabdomyosarcomas . Types of intercellular connections make it possible to establish the histotype of cells. Cytogenetic study and molecular genetic analysis Tumor cells are subjected to cytogenetic study, which, after taking biological material (biopsy, surgery, puncture), are incubated for several days in a thermostat under aseptic conditions. The difficulty lies in isolating viable tumor cells from fresh, “warm”, unfixed material; separating them from the stroma, which in the study of solid tumors can present significant difficulties, because special equipment is needed - homogenizers, filters / grids with a very small mesh size, etc. After the mentioned incubation, a substance that stimulates mitosis is added to the cell culture, then colchicine, under the influence of which a metaphase plate is formed (the synthesis of microtubules from the tubulin protein is blocked, the contraction of which moves the chromosomes to the centers of future daughter cells). After that, a smear is made from the cell culture, which is fixed and stained in a very acidic environment with Giemsa stain. As a result of this staining, the chromosomes acquire a specific uneven staining in the form of bands, which are commonly called G-bands. Each pair of chromosomes has its own specific staining, a kind of "pattern" that changes in the case of chromosomal aberrations (deletions, translocations, inversions). Other molecular biology techniques used for clarifying tumor diagnosis are 24 gene rearrangement studies using southern blotting, flow cytometry, fluorescence in situ hybridization (FISH), multicolor karyotyping,

comparative genomic hybridization, and the most recent development, the use of biochips. A description of these techniques should be found in the relevant manuals. For some types of tumors, where it is possible to obtain clones of tumor cells, such as leukemias and lymphomas, refined maps of chromosomal aberrations have been compiled. Currently, many solid tumors are also subjected to in-depth chromosomal and molecular genetic studies. The development of the above methods has led to the fact that the "gold standard" in the diagnosis of lymphomas and soft tissue sarcomas is now molecular genetics. Morphological studies are closely related to the clinic, the determination of the biological characteristics of tumor growth (sensitivity / resistance to chemotherapy drugs, radiation) and therefore their importance in practical oncology is steadily increasing.