

PRIVATE HIGHER EDUCATIONAL INSTITUTION
"INTERNATIONAL ACADEMY OF ECOLOGY AND MEDICINE"
Department of internal medicine with a course in psychiatry and narcology

WORKING PROGRAM
EDUCATIONAL DISCIPLINE

"Radiology"

LEVEL OF HIGHER EDUCATION Second (master's) level

DEGREE OF HIGHER EDUCATION Master

FIELD OF KNOWLEDGE 22 Health care

SPECIALTY 222 Medicine

Reviewed and approved
at the meeting of the Academic Council
Protocol No. 1, dated August 01, 2017

Kiev 2017

Work program in the discipline " **Radiology** " for the preparation of applicants for a second (master's) higher education level of higher education in specialty 222 Medicine.

1. Description of the academic discipline:

Name of indicators	Characteristics of the academic discipline	
	Full-time education	
Total number: Credits - 4 Hours - 120 Content subdivisions - 9	Mandatory	
	A year of training	3
	Semester	V - VI
	Lectures	20 hours
	Practical	60 hours
	Independent work	40 hours
	Including individual tasks	0
	Final control form	Diff. test

2. The purpose and tasks of the educational discipline

Purpose: The student's acquisition of knowledge and the formation of elements of professional competences in the field of radiology, and improvement of skills and competences acquired during the study of previous disciplines, taking into account the constant improvement of modern radiation medical equipment.

Task:

1. Formation of students' abilities and skills: differential diagnosis, the most common pathological conditions in adults and children.
2. To learn to choose from the existing radiological methods of examination the optimal method of radiological research for detecting functional and morphological changes in the pathology of various organs and systems.
3. Acquisition of skills to analyze the radiation semiotics of functional and morphological changes in the pathology of various organs and systems.
4. Mastering the ability to choose the optimal method of radiation therapy for the treatment of tumor and non-tumor diseases.

The process of studying the discipline is aimed at forming elements of the following competencies :

IR - The ability to solve complex tasks and problems in a certain field of professional activity or in the learning process, which involves conducting research and/or implementing innovations and is characterized by the complexity and uncertainty of conditions and requirements.

ZK2 - Ability to know and understand the subject area and professional activity.

ZKZ - Ability to communicate in the state language.

ZK6 - Ability to work in a team.

ZK8 - Ability to evaluate and ensure the quality of the work performed.

ZK9 - The ability to act on the basis of ethical considerations, socially, responsibly and consciously.

SK1 - Skills of communication and clinical examination of the patient during diagnosis and treatment.

SK2- Ability to determine the necessary list of clinical laboratory and instrumental studies and evaluate their results during diagnosis and treatment.

SCZ - Ability to establish a preliminary and clinical diagnosis.

SK5 - Ability to diagnose emergency conditions.

SK6 - Ability to determine tactics and provide emergency medical assistance.

CK 8 - Ability to perform medical manipulations.

SK12 - The ability to determine the management tactics of persons subject to dispensary supervision.

SK14 - Ability to keep medical documentation.

Expected learning outcomes. As a result of studying the academic discipline, the student must:

Know:

diagnostic methods, radiation syndromes of pathological changes in the most common diseases of various organs and systems

methods of diagnostic and therapeutic procedures appropriate for specific disease states

problems of modern imaging examinations, in particular: 1) radiological symptomatology of major diseases, 2) instrumental methods and imaging techniques used to perform therapeutic procedures, 3) the indications, contraindications and preparation of the patient for particular types of imaging examination and contraindications for the use of contrast agents

Be able:

Possess the skills of communication and clinical examination of the patient. Collect data on the patient's complaints, medical history, life history, which are required for the patient's examination.

Evaluate information about the diagnosis using a standard procedure, based on the results of laboratory and radiological research methods (according to list 4) -

Select the leading radiation symptom or syndrome (according to list 1). Establish a preliminary diagnosis, carry out differential diagnosis and determine the clinical diagnosis of common diseases (according to list 3). Diagnose emergency conditions (according to list 3) in common diseases in children.

Determine the tactics and provide emergency medical assistance to the patient, if this happened during the radiological examination.

Plan the diagnostic procedure and interpret its result.

Perform medical manipulations related to X-ray examinations. To determine the management tactics of persons subject to dispensary examination.

Evaluate the result of a radiological examination in the most common types of fractures, particularly long bone fractures.

Be able to keep medical documentation taking into account the requirements of radiation examination and medical radiation procedures.

Can perform and interpret FAST ultrasound (Focused Assessment with Sonography for Trauma) and other POCUS protocols

Plan, carry out and analyze measures for the organization and integration of providing medical radiation examination to the population.

To comply with the requirements of ethics, bioethics and deontology in their professional area.

Master the skills:

Communication and clinical examination of the patient and be guided by the well-being of a patient.

Perform medical manipulations (according to list 5) for common diseases in children.

Keep medical records for common diseases in children

use objective sources of information.

Perceive and recognize own limitations and self-assessing educational deficits and needs;

To create and maintain close and respectful relationship with patients, as well as to demonstrate tolerance for variations in world views and cultures

3. Content of the educational discipline Subsection 1.

Introduction to radiology. Biological effect of ionizing radiation. Dosimetry.

Topic 1. History of the development of radiology. X-ray photography. Laws of X-ray science .

Wilhelm Konrad Röntgen's discovery of x - ray , Henri Becquerel's discovery of the natural radioactivity of uranium, Marie Sklodowska-Curie and Pierre Curie's discovery of the radioactive properties of polonium and radium . In Ukraine, the first diagnostic X-ray machine produced by the German company " Siemens " was installed in 1908 at the medical faculty of Kyiv University of St. Volodymyr. The Department of Radiology of our University was founded in 1922. Contact and remote methods. Image formation method. Analog and matrix X-ray image receivers. Concept of tomographic section. ZI) - rereading . Natural and artificial contrast.

Topic 2. Types of radiological departments. Features of the organization of radiological and radiological departments.

Types of radiological departments: x-ray diagnostic department or offices, radionuclide diagnostics department, department of therapy with open sources of ionizing radiation (RFP), radiotherapeutic department with closed radioactive drugs, department of remote radiation therapy; where x-ray and u-therapeutic devices, linear accelerators, mixed type are used. Distribution of radiological departments that use open radionuclides by class of work. Classification of sources of ionizing radiation from a hygienic point of view into open and closed. The use of *non-ionizing* radiation sources in medical radiology . Thermal (infrared) MRI radiation (resonant, arising in a static magnetic field under the influence of electromagnetic pulses), ultrasonic waves. Features of the organization of radiological and radiological departments according to the requirements of the Basic Sanitary Rules for Ensuring Radiation Safety of Ukraine (OSPU) and the Radiation Safety Standards of Ukraine (NRBU). Protection of the patient and doctor during medical examinations.

Topic 3. Basic properties of ionizing radiation. Biological effect of ionizing radiation on healthy and pathologically changed cells.

Types of ionizing radiation (corpuscular and photon). Dependence of properties of ionizing radiation on wavelength. Types of properties of ionizing radiation: high energy, high penetrating ability, ionizing ability - the ability to form many pairs of ions when interacting with atoms of the environment, photochemical ability to activate molecules of silver bromide or other chemical compounds, luminescent ability to cause the glow of some substances, thermal action - the ability of ionizing energy radiation turns into heat, strongly expressed biological effect. Radioactivity. Types of protection against ionizing radiation (time, distance, screen, quantity). Means of protection against ionizing radiation (collective and individual). Radiation hygiene regulations.

Topic 4. Radioactivity and dose. Dosimetry of ionizing radiation: units and methods of determining radioactivity and radiation dose.

Dose limits. Permissible levels of de-ionization radiating (IB). Regulation depending on the categories of the population (Category A (specialists), Category B (staff), Category B the entire population). IB Control Levels . Radiation dose regulations. Units of radioactivity and radiation doses. Exposure dose. Absorbed dose. Equivalent dose. Effective dose. Types of devices for measuring dose and radioactivity.

Subsection 2. Visualization methods in radiation diagnostics.

Topic 5. Physical and technical foundations of X-ray examination. Interventional methods of X - ray diagnostics.

Methods of X-ray research (basic (General) and special (auxiliary)). Concepts of fluoroscopy and radiography. Structure and principle of operation of equipment for X-ray studies. Characteristics of radiation used in these studies. Methods of X-ray research: X-ray , X-ray, planar tomography, fluorography. Advantages and disadvantages of each of the methods. Principles of image acquisition in x-ray research methods (radiation source and detector); assignment of methods - study of morphology or (and) function; contraindications to performance; projections and sections of the study. Basics of X-ray science . Natural and artificial contrast. Contrast agents. Indications for their use. Building a clinical and radiological diagnosis. Coronary cardiography . Hagiography of brain vessels.

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Topic 6. Physical and technical foundations of CT research. Physical and technical foundations of PET\CT.

History of development of CT (stepped and spiral). CT as a method of obtaining a spatial X-ray image. Principles of image acquisition. Hounsfield scale . Concepts of "furnace" and " voxel ". Frontal, axial and sagittal planes of research. Diffuse -weighted images. DICOM standard of medical research in dental practice. Density windows. MPR , MIR and SSD reconstruction Multimodality PET/CT. Indication. The concept of Low dose _

Topic 7. Physical and technical foundations of radionuclide research.

Recognition of diseases and pathological conditions using radionuclides and labeled atoms. The concept of radiopharmaceuticals (RFP). RFP in vivo and in vitro . Classification of RFP according to features of accumulation (organotropic , tumoritropic or specific-tropic , without markedly selective accumulation in tissues). The choice of RFP: the clinical target function of the study, the nature of RFP transport in the body, the stability of the radioactive label, ease of preparation and use, cost and availability. RND in vivo : visualization of organs (scanning, scintigraphy , single-photon-mixed CT, positron-mixed tomography, Multimodal : PET CT); changes in the accumulation of RFP in the body and its removal (radiometry, radiography).

Topic 8. Physical and technical foundations of magnetic resonance imaging.

Indications and contraindications.

The discovery of the phenomenon of nuclear magnetic resonance in 1946 by F. Bloch and E. Purcell . The method of obtaining images. Precession. T1 and T2 - relaxation. Axial, sagittal and coronal projections. Spin density. DWI . The effect of radio frequency pulses on various electronic devices inside the patient's body (on cardiac implants : pacemakers, pacemakers). Contrast agents in MRI. Virtual angiography. Contraindications and indications for MRI.

Topic 9. Physical and technical foundations of ultrasound diagnostics. Principles of energy dopplerography .

reflection at the border of different media). Basic characteristics of ultrasound (oscillation period (T), frequency (ν) and wavelength (λ) . Application of ultrasound to obtain images of internal organs . The method of obtaining an image of reflected ultrasound waves. Types of sensors (linear, convex , sectoral). Approaches during ultrasound. Direct and reverse piezoelectric effects. Methods of registering reflected echo signals : A -mode, B-mode, M-mode, Doppler modes, combined modes, modes with construction of a three-dimensional image (3D and 4D), elastography. POCUS protocols (FAST, eFAST, BLUE). Types of access (abdominal, transrectal , transvaginal). Advantages and disadvantages of the method. Problems solved by the ultrasound doctor.

Subsection 3. Complex radiation diagnosis of diseases of the chest cavity.

Topic 10. X-ray research methods and X-ray anatomy of chest cavity organs.

Fluorography. Radiography. Special settings. CT OEC. The expediency of choosing the method of radiation examination of the chest cavity depending on the clinical situation. Segmental structure of the lungs. Additional sub-segments . The concept of the "root" of the lung. The concept of lung pattern. The concept of the tops of the lungs. Lung fields. Imaging of the pleura is normal. Normal location of the mediastinum and diaphragm . Lateral and cardiophrenic sinuses are normal. Comprehensive radiation examination of respiratory organs.

X-ray methods of research of respiratory organs and their characteristics: methods of studying morphological changes of respiratory organs (fluoroscopy, radiography,

magnetic resonance imaging, bronchography, angiopulmonography, bronchial arteriography, CT and MR angiography); methods of studying lung function (inhalation and perfusion scintigraphy, fluoroscopy), functional tests and their value for studying lung function. The principle of obtaining an image, indications and sequence of application of radiographic research methods. Selection of radiopaque substances and RFP. Age-specific features of the use of lung radiography methods. Radiological anatomy and physiology of respiratory organs: thorax, tracheobronchial tree, lung roots and pulmonary pattern, their morphological substrate. Age-related features of radiological anatomy and physiology of the lungs.

The plan of radiation research. Indications and contraindications for carrying out this or that radiation method of research of respiratory organs. Radiological signs of diseases of the respiratory organs: darkening of the lung field or part of it, lightening of the lung field or part of it, changes in the lung pattern and the root of the lung, displacement of mediastinal organs. Characteristics of eclipses by size, number, intensity, shape, structure, contours. Symptoms of impaired ventilation and lung perfusion. A plan for studying the X-ray examination of the chest cavity, building an algorithm for further radiological examination of the patient. Radionuclide semiotics of lung pathology - violations of pulmonary perfusion and ventilation, diffuse and focal processes in the lungs, pathological content in the pleural cavity. The main radionuclide syndromes of lung pathology, their morphological substrate.

Ultrasound semiotics of lung pathology (subpleural departments), pleural cavity and mediastinum - tumors, cavity formations, enlarged lymph nodes. The main ultrasound syndromes of lung and mediastinal pathology, their morphological substrate.

Topic 11. Basics of radiation semiotics of the pathology of the chest cavity. Pathological syndromes of changes in the organs of the chest cavity (darkening, lightening, pathology of the root, pathology of the pulmonary pattern). "POCHIFORAINRICOS" is an instruction for describing the X-ray of the organs of the chest cavity. Determination of pathological changes according to the formula: in front-behind, in the lung-in the lung. Intrasyndromic diagnosis of blackout by prevalence: total, subtotal, limited blackout (miliary, small-focal, medium-focal, large-focal, masses). Volumetric changes of pulmonary structures (atelectasis, fibrosis, consolidation). The most frequent causes of dissemination. Hydrothorax. An approximate estimate of the amount of fluid in the pleural cavity. Hydropneumothorax. Intra-syndromic diagnosis of lightening by the thickness of the walls and the condition of the adjacent lung tissue: emphysema, bulla, cyst, cavern. Assessment of the root according to size: common (due to lymph nodes, neoplasms, aortic aneurysm, spread of the superior vena cava, lung atelectasis). X-ray signs of atelectasis and segmental pneumonia. Evaluation of the root based on location (displacement). X-ray diagnostics of acute and chronic inflammatory processes of the respiratory organs and traumatic injuries of the chest cavity: bronchitis; pneumonia and complications (abscess, destruction, pleurisy); pneumo-, hydro-, hydropneumothorax. Algorithms of radiation examination in this pathology.

Topic 12. Radiation signs of inflammatory diseases of the respiratory organs.

Radiation semiotics of pulmonary tuberculosis.

Radiation signs of bronchopneumonia, segmental and partial pneumonia. Changes in the pulmonary pattern. Matte. Curly lines. Types of bronchiectasis and radiography. Inflammatory complication of hypoplasia. Suppuration of cysts. Radiological signs of lung abscess and abscess pneumonia. Common manifestations and differences. Viral, fungal pneumonias in the X-ray image. Radiological signs of aspiration pneumonia in comparison with pneumonitis. Radiation signs of viral pneumonia on the example of pneumocystis pneumonia. Types of alveolitis, radiation signs. Radiation manifestations

primary forms of tuberculosis in children (primary tuberculosis complex (PTC), tuberculosis of intrathoracic lymph nodes). Signs of disseminated tuberculosis. Types of dissemination (bronchogenic, hematogenous, lymphogenic). Radiological manifestations of fibrous-cavernous and focal tuberculosis.

Topic 13. Radiation signs of lung tumors.

X-ray signs of violation of bronchial patency (hyperventilation, hypoventilation, atelectasis). Tactics of examination of a patient with signs of impaired bronchial patency on CT scan, formation of a protocol. Radiation manifestations of central lung cancer in a CT scan. Peculiarities of radiation manifestations of Penkosta cancer, peculiarities of interpretation of images in CT windows. Methods of targeted search for complications and metastatic impression.

Topic 14. Methods of X-ray research of the cardiovascular system. Radiological anatomy of the cardiovascular system. Radiation signs of diseases of the cardiovascular system.

Radiological methods of research of the heart, vessels and mediastinal organs and their characteristics (roentgenography, fluoroscopy, echocardiography, doppler echo - cardiography, radiocardiography, radioventriculography, myocardial scintigraphy, computed tomography, magnetic resonance tomography, angiocardiology, ventriculography, coronary angiography, aortography, cavography). The formation of the arcs of the heart in the X-ray image. Features of the image of the heart in young children. Formation of cardiac arches on an X-ray. Cardiothoracic index (CTI). Age norm of the cardiovascular system in radiography. Congenital heart defects (tetrad Fallo, ventricular septal defect, atrial septal defect). X-ray examination with contrast a safety wire to assess the size of the left atrium and left ventricle. Changes in the pulmonary pattern in congenital and acquired heart defects. Heart tumors. X-ray signs of pericarditis and mediastinitis. Radiological manifestations of pneumomediastinum. Classification of research methods according to sequence (primary, additional), invasiveness (non-invasive, invasive), obtained information (morphological, functional). The principle of obtaining an image and indications for the use of radiological methods for the study of the heart, mediastinum and blood vessels. Contrast agents and RFP, used for radiographic examination of the heart and blood vessels. The concept of X-ray endovascular interventions and indications for their use. Age features of the use of radiological research methods. Radiological anatomy of the mediastinum, heart and main vessels: X-ray, ultrasound and CT anatomy in standard projections. The main morphometric parameters of the unchanged heart and main vessels. Evaluation of the results of X-ray examination of heart function: M-mode,

Doppler echocardiography, dynamic radiocardiography, radionuclide angiocardiology, perfusion scintigraphy. Age-related features of the radiological anatomy and physiology of the heart and main vessels. Classification of mediastinal lymph nodes. The plan of radiation research. Indications and contraindications for carrying out this or that radiation method of CCC research. Radiological signs of lesions of the mediastinum, heart and blood vessels. Changes in the position of the heart: oblique, vertical, horizontal, dextroposition. Extracardiac causes of changes in the position of the heart. Changes in the shape of the heart (mitral, aortic, trapezoidal), causes of their formation. Changes in the size of heart chambers, methods of determination. Violation of heart contraction, assessment methods. Algorithms of X-ray research and the main X-ray symptoms in some heart diseases: coronary disease and its complications, acquired (mitral, aortic) and congenital (with impoverished, enhanced and unchanged pulmonary circulation) heart defects, myocarditis, pericarditis. Algorithms of X-ray research and the main X-ray symptoms of vessel stenoses and occlusions, aneurysms, varicose veins (aorta, vena cava, vessels of limbs).

Subsection 4. Complex radiation diagnosis of diseases of the abdominal cavity.

Topic 15. Radiological research methods and radiological anatomy of abdominal organs.

Expediency and research methods of insurance with contrast. Methodology of radiography of the abdominal cavity with barium contrast and irrigoscopy. The display of physiological constrictions is safe do _ X-ray image of the stomach and the 12-digit colon, the colon and rectum are normal (size, location, folds, palpation). The image of the intestine is normal during irrigoscopy. Abdominal CT capabilities. The feasibility of contrast enhancement.

Topic 16. Basics of radiation semiotics of the pathology of abdominal organs. Radiation signs of diseases of the gastrointestinal tract.

The most widespread radiation symptoms of the pathology of the lining (narrowing, spreading; lengthening, shortening; pathological changes in the topography of the mucous membrane). Signs of insurance cord atresia. Foreign bodies of the esophagus. Achalasia of the esophagus. Radiant manifestations of care diaphragm safety hole. Signs of a violation of the location of the stomach under the pressure of a displaced liver and spleen, with tumors of the pancreas. Chronic gastritis causes a syndrome of pathological changes in the mucous membrane of the stomach and intestines. Radiation symptoms of diseases of the alimentary canal. The main radiological signs of the pathology of the alimentary canal: free gas in the abdominal cavity, areas of intestinal distention, shadows of foreign bodies and calculi, narrowing (diffuse, local, symmetrical, asymmetric), expansion (diffuse, local, symmetrical, asymmetrical), irregularity of the contour (straightening, "niche", filling defect), mucosal changes (remodeling of the relief, "niche", filling defect).

Radiation syndromes of foreign bodies: esophagus, stomach, intestines - their complications. Algorithms of X-ray examination for perforation of a hollow organ in the abdominal cavity, tumors of the esophagus, stomach, intestines. Conductive radiation syndromes of achalasia (dilatation) of the esophagus, cicatricial strictures. Leading radiation syndromes of diseases of the alimentary canal: "acute abdomen"; inflammation (esophagitis, gastritis, enteritis, colitis); peptic ulcer disease of the stomach and duodenum and its complications; malignant (cancer); benign (polyps) tumors; developmental defects; functional disorder (atonia, hypotension, hypertension, reflux); intestinal obstruction.

Topic 17. Radiation diagnosis of complicated peptic ulcer disease.

Radiological difference between erosion and ulcer of the stomach and duodenum. Manifestations of peptic ulcer disease: expansion of the stomach or bulb, a protrusion (niche) on the contour of the body of the stomach or bulb. Symptoms of impaired function of the stomach and duodenum in peptic ulcer disease: the presence of fluid in the stomach on an empty stomach, regional spasm, "finger" indicating an ulcer, accelerated advancement of the contrast agent. The presence of air and/or contrast outside the stomach and duodenum as a manifestation of the complication of peptic ulcer disease. Peculiarities of the use of different types of contrast agents when examining patients with peptic ulcer disease.

Topic 18. Radiological research methods and radiological anatomy of the hepatobiliary system.

Ultrasound scanning, CT and MRI with contrast enhancement, radioscintigraphy, CRPG, celiacography. Expediency of appointment in various clinical cases. Possibilities and advantages\disadvantages of radiodiagnosis methods. Radiological methods of liver and biliary tract research: X-ray examination and radiography, artificial contrast of organs using X-ray positive and X-ray negative contrast substances, ultrasound, CT, MRI. Radionuclide methods of liver and biliary tract research. RFPs, which are used in conducting radionuclide studies of the liver. Preparation of the patient. Indications and contraindications for carrying out this or that radiological research method. Normal ray anatomy and physiology. Segmental structure of the liver. Features of liver blood supply.

Topic 19. Radiation signs of diseases of the hepatobiliary system. Examination tactics, semiotics of gallstone disease. Modern radiation methods of examination and treatment of gallstone disease and pancreas.

Diffuse liver lesions (fatty hepatosis , chronic hepatitis and cirrhosis). Local impressions of the liver (focal impressions and abscesses). Damage to the gallbladder and bile ducts (acute cholecystitis and its complications). X-ray signs of the impression of the bile ducts (local, diffuse). CT signs of acute pancreatitis (necrotic and edematous forms). Removal of stones under ultrasound control. RCP prosthetics of the ducts of the pancreas.

Subsection 5. Complex radiation diagnostics of diseases of the urinary system.

Topic 20. Radiological research methods and radiological anatomy of the urinary system. Radiological signs of abnormalities in the development of the urinary system.

Overview X-ray, excretory and infusion urography , retrograde pyelography, antegrade pyelography, renal angiography (selective), venography , digital subtraction angiography, cystography, ureterography , CT and MRI (without and with contrast), radioisotope methods (x-ray, dynamic renal scintigraphy , SPECT). Segmental structure of kidneys. Kidney blood supply variants and anomalies). Anomalies of kidney development: agenesis, aplasia, hypoplasia, multicystic dysplastic kidney, polycystosis , dystopia , malrotation , anomalies of kidney distribution, doubling of the collecting system of the kidneys, obstruction of the ureter-bladder joint mouth , ureter ectopy , ureterocele .

Topic 21. Radiation signs of kidney and urinary tract diseases. Tactics of radiation examination and radiation semiotics of urolithiasis. Ultrasound method in the diagnosis and treatment of urolithiasis. Radiation signs of tumors of the urinary system.

Acute pyelonephritis in a CT image. Features of CT imaging of chronic pyelonephritis. Research and staging algorithm . Kidney abscess. X-ray signs of complications of polycystic kidneys. Bladder-ureteric reflux . Radiation staging . Complication. Algorithm of examination of a patient with urolithiasis . Ultrasound method in the diagnosis and treatment of urolithiasis. Modern multimodal ultrasound devices for simultaneous diagnosis and treatment. Classification of cysts according to Bosniak. Wilms tumor . Malignant kidney tumors.

Subsection 6. Complex radiation diagnosis of diseases of the musculoskeletal system.

Topic 22. Radiological research methods and radiological anatomy of the locomotor system. Radiological signs of inflammatory diseases of the musculoskeletal system.

X-ray of bones. Mandatory polypositional image. CT examination of bones. Bone window. The structure of long bones in the X-ray image (epiphysis, metaphysis , diaphysis). Mobility (syndesmosis , synostosis , joint). Ratio of bone structures in the joint. Features of X-ray imaging of vertebrae in age-related development. Algorithm for evaluating radiographs of the musculoskeletal system: shape and size, number, contours, structures of the cyst and periosteum, joint gap and joint relationship. Processes with a decrease in bone tissue: osteoporosis, destruction, osteolysis , atrophy, osteomalacia. Processes with an increase in bone tissue: osteosclerosis, periosteal layering, hypertrophy, parostosis , heterogeneous ossification. Necrosis and bone sequestration. Osteomyelitis (acute, subacute , chronic). Ray classification. Reversibility of manifestations of osteomyelitis. Features of hematogenous osteomyelitis . Garret's sclerosing osteomyelitis . Brody's abscess. Bone tuberculosis.

Topic 23. X-ray diagnosis of dysplasia of hip joints and anomalies of bone development. Rickets-like diseases.

Determination of disorders in the hip joint according to the Hilgenreiner scheme . Signs of changes in the hip joints of babies: dysplasia , subluxation, dislocation. Ultrasound method of prenatal diagnosis of hip joints. Common radiation manifestations of vitamin D-dependent rickets, phosphate diabetes, renal calcium acidosis, Toni- Debray - Fanconi disease . Mandatory examination of children in case of suspicion of rickets-like diseases. Detection of signs of deformations of the diaphyses of the long bones of the arms and legs on radiographs, blurring of their metaphyses with the presence of cup-shaped depressions , deformation of the ribs such as pearl rosaries on the ribs.

Topic 24. Radiation signs of traumatic injuries of the musculoskeletal system.

Traumatic injury during childbirth. Organization of examination of newborns with birth trauma. Non-accidental injury in children. Algorithm of the study of the child and the doctor's behavior. Classification of traumatic injury of long bones in children and adolescents (osteopiphysiolysis). The mechanism of injury of long bones and their X-ray reflection in adults. Algorithm for describing the radiographic image (localization of traumatic injury, presence/absence/displacement of fragments, direction and angle of displacement of fragments, ratio of adjacent structures, possibility of joint damage, absence/presence of bone callus, density and increase of soft tissues). Expediency of additional examination of the patient on CT.

Topic 25. Radiation signs of diseases of the spine. X-ray signs of joint changes in rheumatoid arthritis, deforming osteoarthritis , collagenoses .

Signs of cervical, thoracic, lumbar vertebrae are normal. Retro and antelistsis of vertebrae. Change in the height of the vertebra (fracture and pathological fracture). Fixing ligamentosis (Bekhterev's disease , Forestier's disease). Spondylosis . Classification of rheumatoid arthritis according to X-ray changes. X-ray signs of pathological changes in deforming osteoarthritis , collagenosis .

Topic 26. Radiological signs of tumors of the musculoskeletal system.

Classification of tumor processes of bone tissues by origin. Algorithm for diagnosing tumors of the musculoskeletal system, taking into account the localization of pathological changes and the age of the patient. The leading value of the radiographic method, CT and MRI is auxiliary for clarification, planning of the operation and postoperative control. Transition zone in the diagnosis of benign and malignant tumors. Assessment of periosteal reaction (benign and aggressive). Changes in the bone matrix. Prevalence of pathological changes. The presence of destruction. Evaluation of the density of pathological changes on CT.

Subsection 7. Comprehensive radiation diagnosis of diseases of the breast, reproductive and endocrine systems.

Topic 27. Radiological research methods and radiological anatomy of the reproductive system. Radiation signs of diseases of the reproductive system.

Radiological methods of genital examination: ultrasound, x-ray, radionuclide (in vitro and in vivo), CT, MRI. Radiological anatomy of male and female genital organs. Visualization of male and female genital malformations. Agenesis and hypoplasia of the genitals, disordered location, doubling. Possibilities and main indications and contraindications for radiation examination of the genitals. Peculiarities of preparing patients for radiation examination. Contrast agents and features of their use. Radiation semiotics of genital diseases .

Topic 28. Radiological research methods and radiological anatomy of the breast. Radiation signs of breast diseases. Normal radiological anatomy of the breast.

Segmental structure. Age-related features of the breast structure . Embryonic milk tract. Anomalies and developmental defects of the mammary gland in men and women: hypoplasia, amastia , amazia , polycelia , polymastia). Associations with other diseases and pathological

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syndromes fetal alcohol syndrome, family alcoholism, developmental delay, Turner syndrome, Fanconi anemia, ectodermal dysplasia, pyloric stenosis, peptic ulcer disease.

Mammography is the "gold standard" of breast examination. Modern introduction to MRI practice. Depending on international health regulations, MRI is used both for screening women at high risk of developing breast cancer (for example, BRCA -1 and BRCA -2 carriers) and as an additional diagnostic test during previous breast cancer therapy. monitoring of primary systemic therapy and for solving problematic diagnostic situations when direct biopsy is impossible. Gynecomastia - calculation in estimates: in infants (reaction to hormonal stress during childbirth), and elderly men (benign ductal and stromal proliferation as a result of a decrease in testosterone levels, a state of hypogonadism / androgen deficiency: syndrome

Klinefelter's disease, anarchy, testicular failure (for example, testicular cancer), in young and mature men (alcoholic cirrhosis, drugs, chronic lung disease, for example, emphysema, tuberculosis, malnutrition, hyperthyroidism, the result of hemodialysis in chronic renal failure, the presence of a high level of estrogens (adrenal tumor). Men have the same pathological changes as women. Mastopathies. X-ray classification: diffuse mastopathy with a predominance of the glandular component (adenosis), diffuse fibrocystic mastopathy with a predominance of the fibrous component, diffuse fibrocystic mastopathy with a predominance of the cystic component, mixed diffuse fibrocystic mastopathy, sclerosing adenosis _ Features of the image of each form of mastopathy (diffuse dyshormonal hyperplasia).

Topic 29. Radiation diagnosis of breast cancer.

Paget's cancer. Lobular and intraductal breast cancer. Edema is an infiltrative form of breast cancer. Non-invasive (non-infiltrating) cancer is a special form that does not metastasize. The diagnostic value of the presence of calcifications for the certainty of cancer: a higher probability of malignancy in the presence of microcalcifications and

benignity of the process in the presence of macrocalcifications. Primary, secondary (symptoms of thickening of the skin, its retraction, retraction of the nipple, enlargement of lymph nodes) and indirect symptoms (asymmetrically located area of increased density, violation of the normal architecture of breast tissue, stellate induration with heavy contours, subareolar dilatation of ducts) symptoms of breast cancer. Sarcoma of the mammary gland is characterized by rapid growth over months to gigantic sizes. Protrusion of breast tissue above the tumor. Characteristic hematogenous metastasis to the lungs and bones.

Topic ZO. Radiation methods of treatment of diseases of the genital area. Endovascular methods of treatment of diseases of the reproductive system.

Features endovascular accesses _ Contrast agents. Protection of the patient and medical personnel. Preoperative preparation. Indications and contraindications. Angiography of uterine vessels, identification of relevant vessels, embolization of arteries that feed a benign tumor. Methods and algorithms for controlling tumor involution.

Topic 31. Radiation methods of research in endocrinology. Radiation signs of diseases of the thyroid gland.

Radiological imaging methods of the thyroid gland: ultrasound, radionuclide, X-ray, CT, MRI. Normal ray anatomy and physiology. Radiological imaging methods of the thyroid gland: ultrasound and radionuclide scintigraphy, CT, MRI. The main RFP. Preparation of patients for radionuclide examination of the thyroid gland. X-ray study of the functional state of the thyroid gland

glands; accumulation test with I, dynamic thyroscintigraphy with Ts-per technetate, RIA of hormones T-3, T-4, TSH, TG. Indications and contraindications for this or that radiological method of thyroid research. Compilation of the algorithm of radiation research.

Radiation semiotics of pathology of the endocrine system: hypo- , hyperthyroidism , tumor lesions of the thyroid gland, inflammatory processes, abnormal location of the thyroid gland.

Topic 32. Radiation diagnosis of thyroid cancer.

Types of thyroid cancer: papillary, follicular, medullary, undifferentiated . Limited capabilities of CT, thyrolymph - , pneumothyroid - , thermo - , angio - and radiography. Ultrasound semiotics of thyroid cancer. Thin needle aspirational puncture biopsy (TAPB) under ultrasound control.

Features of the conduct. Radioisotope scanning of the thyroid gland with iodine preparations reveals "hot" ("warm") and "cold" nodes. Additional methods to control the spread of the disease: CT, radioisotope scanning with Ts-99t-MIVI, PET CT.

Content section 8. Comprehensive radiation diagnostics of diseases of the central nervous system, in oncology and emergency conditions.

Topic 33. Radiological research methods and radiological anatomy of the central nervous system. Radiation signs of diseases and injuries of the central nervous system.

Radiation methods of CNS research. X-ray methods of studying the skull and brain (radiography of the skull, ventriculography , cisternography).

Angiographic methods of CNS research. CT and MRI of the brain and spinal cord. Radiological anatomy of the skull and brain. Radiological anatomy of the spine and spinal cord. Algorithm of application of radiation research methods in oncology. Ultrasound semiotics of tumors. Algorithm of the study of a patient with neurotrauma in the reception department. The severity of the condition does not always correlate with the detected injuries of the locomotor system. Glasgow scale. The concept of penumbra . Traumatic injuries of the skull: types of fractures of the facial skeleton according to Le Fer , carpal bones, basilar trauma of the skull. Classification of hematoma epidural , subdural , subarachnoid, intracerebral with or without breakthrough into the ventricles. Radiological symptoms of brain damage: contusion, edema, diffuse axonal damage (DAP), extravasation of contrast material (rupture of blood vessels). Indirect signs of brain injury: dislocation entrapment , edema, brain atrophy . Symptoms of spinal cord injury: stenosis, contusion of the spinal cord , intracerebral hematoma, subarachnoid hemorrhage (SAH), traumatic injuries of the vertebrae... Vascular diseases of the brain: rupture of an aneurysm of the vessels of the brain , arteriovenous malformation (AVM). Infectious and inflammatory diseases of the brain. Abscess, toxoplasmosis. Radiation signs of brain tumors. Pituitary tumors, interventional neuroradiology . Radionuclide studies of the central nervous system (static scintigraphy , SPECT, PET studies). RFPs used for radionuclide research of the central nervous system.

Topic 34. Radiation diagnosis of stroke. Endovascular radiation methods of treatment of strokes and heart attacks.

Algorithm for examining a patient with suspected stroke. Therapeutic window. Patient examination algorithm. Early signs of an ischemic stroke : unilateral symptom without contrast angiografi , s-m insular tapes, Possibilities endovascular angiosurgical interventions in ischemic stroke. Thrombolysis and thromboextraction . Indications and contraindications. Research algorithm of a patient with a hemorrhagic stroke.

Topic 35. Radiation diagnostics in oncology.

Radiation signs of malignant kidney tumors. Criteria for choosing radiodiagnostic methods, assessment of prevalence according to TNM . Radiation signs of malignant tumors of the esophagus and stomach. Criteria for choosing radiodiagnostic methods, assessment of prevalence according to TNM . Radiological signs of malignant tumors of the intestine. Criteria for choosing radiodiagnostic methods, assessment of prevalence according to TNM .

Topic 36. Radiation signs of emergency conditions.

Features of emergency radiation examination. It is performed around the clock, at the optimal time¹, quickly, and can be performed in the ICU or operating room. Contraindications to an urgent radiological examination are extremely limited and relative: the presence of profuse internal or external bleeding, which requires immediate surgical intervention, a sharp violation of the body's vital functions, severe movement disorders, which negates the informativeness of the study. Multiplicity and uncertainty of traumatic injuries. High energy trauma.

Topic 37. Radiation signs of urgent respiratory conditions.

OGK injury with / or without lung damage, air leak syndrome (SVP), RDS (shock lung) of children and adults (may be in a child), pulmonary edema, PE, aspiration syndrome (foreign body of bronchi and lungs, drowning), damage aorta, damage to the diaphragm and/or esophagus. Pulmonary edema. Signs of interstitial pulmonary edema: the caliber of the upper veins prevails, a decrease in the transparency of the lung fields, the indistinctness of the contours of the lung pattern, small focal shadows, infiltration in the peribronchial sections, Curley lines A, B and C, there may be effusion in the pleural cavity and the pericardial cavity. Alveolar edema of the lungs: bilateral damage, infiltration is localized more in the basal zones ("butterfly" shape), the roots are expanded, their contours are unclear, fast dynamics. Damage to the ribs can lead to the secondary development of pneumothorax (open, closed, valvular (tension), hemothorax, pneumohemothorax, subcutaneous emphysema, lung damage (contusion, bleeding), trauma to the diaphragm, spleen, heart. Classification of rib fractures: stable\unstable, unilateral\ bilateral, single\multiple. Floating rib fractures. Rupture of bronchi\trachea. Pneumomediastinum. Contusion (contusion) of the lung. Hematoma of the lung. Traumatic cysts.

Topic 38. Radiation signs of emergency conditions of the cardiovascular system.

BODIES. Aortic aneurysm.

BODIES: massive, submassive, nonmassive. Phases of development of PE: oligemia and organization of emboli; lung infarction phase; reverse development. X-ray symptoms of oligemia: at the beginning, a significant increase in the transparency of lung tissue, impoverishment of the lung pattern is observed in the affected area; occlusion of the large branches of the pulmonary artery leads to the development of acute pulmonary heart disease - the right parts of the heart enlarge, the arc of the pulmonary trunk explodes, the superior vena cava expands; in case of partial branch occlusion - reduction of the size of the corresponding part of the root and expansion of the functioning branch; in the case of occlusion of small branches, there are no signs of oligemia, focal or focal -draining shadows, effusion in the pleural cavity are observed. In the phase of infarction: focal and focal confluent shadows, triangular shadow, round shadow, segmental shadow. At the stage of resorption: the contours of the infarct shadow become wavy, the shape is elongated, the structure is less uniform; after 3-4 weeks, a zone of pneumosclerosis or a linear scar is formed.

Topic 39. Tactics of radiation examination of a patient with signs of "acute abdomen". Intestinal obstruction.

Algorithm of the most likely diagnosis in a patient with an "acute abdomen" according to the localization of pain. Peculiarities of the study. Acute cholecystitis (right upper quadrant), appendicitis (right lower quadrant), acute pancreatitis (diffuse back pain), ultrasound ICT symptoms of acute appendicitis. The symptoms of its complications have changed. Classification of intestinal obstruction: strangulation obstruction of the small, large intestine (volvulus, nodule formation, globular obstruction, restriction in keel openings); obturational obstruction of the small and large intestine (cicatricial narrowing, blockage by a tumor, roundworms, gallstones); functional obstruction of the intestine (obstruction due to impaired blood circulation in the mesentery (thrombosis and embolism of mesenteric vessels, metastases of cancer in the mesentery (cancerous peritonitis); obstruction due to intoxication of the body (poisoning with food, lead and other poisons, peritonitis (diffuse or limited); obstruction

due to diseases and injuries of various organs and systems of the body (Diseases of the gastrointestinal tract (1) appendicitis, enteritis, colitis, diverticulitis ; 2) diseases of other organs of the abdominal cavity (hepatitis, cholecystitis, salpingitis- oophoritis , etc.; 3) diseases of the retroperitoneal organs space (pancreatitis, pyelitis, paranephritis, kidney stone disease); 4) diseases of the abdominal wall (phlegmon, hematoma); 5) diseases of the chest organs (pneumonia, pleurisy, fractures of the lower ribs , pneumothorax, hemothorax, pericarditis, myocardial infarction, dissecting aneurysm of the aorta, etc. 6) diseases of the nervous system (various lesions of the brain and spinal cord, neuroses, hysteria. Radiation symptoms of intestinal obstructions: Casey's symptom, pneumoperitoneum , Kloiher glasses , "twos" (duplet). Ultrasound examination in injuries. POCUS protocol, including FAST, eFAST, BLUE.

Content section 9. Principles and methods of radiation therapy.

Topic 40. Principles and methods of radiation therapy.

Conducting radiation therapy in the optimal dose at the optimal time. General (irradiation of the tumor in the optimal dose), special (treatment of this particular disease) and special (development of radiation therapy plan individually for each patient) rules. The choice of the optimal dose takes into account the histology of the tumor, the characteristics of its growth (exophytic , infiltrative), the tolerance of nearby healthy tissues. Radiotherapy interval. Radio modifiers : radio protectors and radio sensitizers . Course of radiation therapy: before radiation, radiation, after radiation.

Types of radiation therapy depending on the goal: radical, palliative, symptomatic.

Indications for each type. Methods of radiation therapy: independent, combined, complex, combined radiation therapy. Programs of the independent method: radical, palliative, symptomatic. Programs of the combined method: preoperative irradiation, suboperative irradiation, postoperative irradiation. Complex method of treatment: chemotherapy together with radiation and surgical treatment. Combined radiation treatment method: external irradiation with contact radiation therapy. Combined methods of treatment: preoperative, suboperative and postoperative.

Topic 41. Basics of radiation therapy for tumor and non-tumor diseases.

Radioiodine therapy for thyroid cancer using J^{131} . Use of small doses of RFP with iodine in the treatment of angina pectoris, syringomyelia , spinal and cerebral arachnoiditis. Indications, contraindications. Principles of radiotherapy of non-neoplastic diseases. Mechanisms of anti-inflammatory effect of radiation therapy. Use in inflammatory processes: panaritium, osteomyelitis, thrombophlebitis. Application for all diseases: chronic dermatoses, mycoses. Radiation reactions and damage. Local radiation damage (early, late).

Topic 42. Radiation therapy methods: X-ray therapy; contact methods; long distance gamma therapy and radiation therapy with high energy sources. Goals, tasks, opportunities. Irradiation rhythm. Types and features of application. Clinical and dosimetric control. Typometry. Individual topometric -anatomical map. Sources of ionizing radiation: charged particle accelerator, radionuclides (closed and open). Radiation therapy methods depending on the distance of radiation sources. External (far-distance, close-focus, application) and internal sources of radiation. Contact methods of radiation therapy: intra-hollow, intra-tissue, incorporated elements. Remote therapy: X-ray therapy, gamma therapy, irradiation with high energy sources. X-ray therapy: superficial, semi-deep , deep. Gamma therapy: static, dynamic. Irradiation by high-energy sources: linear accelerators, cyclic accelerators (betatrons, synchrophasotrons). Dose distribution in space: static and dynamic exposure.

4. The structure of the academic discipline

Topic	Number of hours			
	In total	Including		
		L.	Pr. gen	SRS
Unit 1. Introduction to radiology. Biological effect of ionizing radiation. Dosimetry.				
Topic 1. History of the development of radiology. X-ray photography. Laws of X-ray science .	4.0			4.0
Topic 2. Types of radiological departments. Features of the organization of radiological and radiological departments.	2.0	2, 0		
Topic 3. Basic properties of ionizing radiation. Biological effect of ionizing radiation on healthy and pathologically changed cells.	2.0		2.0	
Topic 4. Radioactivity and dose. Dosimetry of ionizing radiation: units and methods of determining radioactivity and radiation dose.	2.0		2.0	
Subsection 2. Visualization methods in radiation diagnostics.				
Topic 5. Physical and technical foundations of X-ray examination. Interventional methods of X-ray diagnostics.	4.0	1, 0	2.0	1.0
Topic 6. Physical and technical foundations of CT research. Physical and technical foundations of PET\CT.	5.0	1, 0	2.0	2.0
Topic 7. Physical and technical foundations of radionuclide research.	3.0	1, 0	2.0	
Topic 8. Physical and technical foundations of magnetic resonance imaging. Indications and contraindications.	4.0	1, 0	2.0	1.0
Topic 9. Physical and technical foundations of ultrasound diagnostics. Principles of energy dopplerography .	3.0		2.0	1.0
Subsection 3. Complex radiation diagnosis of diseases of the chest cavity.				
Topic 10 . Radiological research methods and radiological anatomy of chest cavity organs.	6.0	2, 0	2.0	2.0
Topic 11 . Basics of radiation semiotics of the pathology of the chest cavity.	2.0	2, 0		
Topic 12 . Radiation signs of inflammatory diseases of the respiratory organs. Radiation semiotics of pulmonary tuberculosis.	4.0		2.0	2.0
Topic 13. Radiation signs of lung tumors.	2.0		2.0	
Topic 14. Methods of X-ray research of the cardiovascular system. Radiological anatomy of the cardiovascular system. Radiation signs of diseases of the cardiovascular system.	5.0		2.0	1.0
Subsection 4. Complex radiation diagnosis of diseases of the abdominal cavity.				
Topic 15. Radiological research methods and radiological anatomy of abdominal organs.	3.0	1, 0	2.0	
Topic 16. Basics of radiation semiotics of the pathology of abdominal organs. Radiation signs of diseases of the gastrointestinal tract.	5.0	1, 0	2.0	2.0
Topic 17. Radiation diagnosis of complicated peptic ulcer disease.	2.0			2.0
Topic 18. Radiological research methods and radiological anatomy of the hepatobiliary system.	2.0		2.0	
Topic 19. Radiation signs of diseases of the hepatobiliary system. Examination tactics, semiotics of gallstone disease. Modern	5.0		2.0	3.0

radiation methods of examination and treatment of gallstone disease and pancreas.				
Subsection 5. Complex radiation diagnostics of diseases of the urinary system.				
Topic 20. Radiological research methods and radiological anatomy of the urinary system. Radiological signs of abnormalities in the development of the urinary system.	2.0		2.0	
Topic 21. Radiation signs of kidney and urinary tract diseases. Tactics of radiation examination and radiation semiotics of urolithiasis. Ultrasound method in the diagnosis and treatment of urolithiasis. Radiation signs of tumors of the urinary system.	7.0	2,0	2.0	3.0
Subsection 6. Complex radiation diagnosis of musculoskeletal diseases systems.				
Topic 22. Radiological research methods and radiological anatomy of the locomotor system. Radiation signs of inflammatory diseases of the musculoskeletal system.	5.0	2,0	2.0	
Topic 23. X-ray diagnosis of dysplasia of hip joints and anomalies of bone development. Rickets-like diseases.	1.0			1.0
Topic 24. Radiation signs of traumatic injuries of the locomotor system.	2.0		1.0	1.0
Topic 25. Radiation signs of diseases of the spine. X-ray signs of joint changes in rheumatoid arthritis, deforming osteoarthritis, collagenosis.	2.0			2.0
Topic 26. Radiological signs of tumors of the musculoskeletal system.	2.0		2.0	
Subsection 7. Complex radiation diagnosis of diseases of the breast gland, reproductive and endocrine systems.				
Topic 27. Radiological research methods and radiological anatomy of the reproductive system. Radiation signs of diseases of the reproductive system.	2.0		2.0	
Topic 28. Radiological research methods and radiological anatomy of the breast. Radiation signs of breast diseases.	2.0		2.0	
Topic 29. Radiation diagnosis of breast cancer.	1.0			1.0
Topic ZO. Radiation methods of treatment of diseases of the genital area. Endovascular methods of treatment of diseases of the reproductive system.	2.0			2.0
Topic 31. Radiation methods of research in endocrinology. Radiation signs of diseases of the thyroid gland.	2.0		2.0	
Topic 32. Radiation diagnosis of thyroid cancer.	1.0			1.0
Content section 8. Complex radiation diagnosis of diseases of the cardiovascular system, oncology and emergency conditions.				
Topic 33. Radiological research methods and radiological anatomy of the central nervous system. Radiation signs of diseases and injuries of the central nervous system.	2.0		2.0	
Topic 34. Radiation diagnosis of stroke. Endovascular radiation methods of treatment of strokes and heart attacks.	with, about			3.0
Topic 35. Radiation diagnostics in oncology.	2.0		2.0	
Topic 36. Radiation signs of emergency conditions.	4.0	2,0	2.0	
Topic 37. Radiation signs of urgent respiratory conditions.	1.0			1.0
Topic 38. Radiation signs of emergency conditions of the cardiovascular system. BODIES. Aortic aneurysm.	2.0			2.0
Topic 39. Tactics of radiation examination of a patient with symptoms	2.0		3.0	2.0

"sharp stomach". USG POCUS protocols training in trauma				
Content section 9. Principles and methods of radiation and therapy.				
Topic 40. Principles and methods of radiation therapy.	2.0	2,0		
Topic 41. Basics of radiation therapy for tumor and non-tumor diseases.	2.0		2.0	
Topic 42. Radiation therapy methods: X-ray therapy; contact methods; long distance gamma therapy and radiation therapy with high energy sources.	2.0		2.0	
Final control of mastering the discipline.	2.0		2.0	
Hours in general:	120	20	60	40

5. Topics of lectures

No	Topic
1	Types of radiological departments. Features of the organization of radiological and radiological departments. OSPU NRBU.
2	Physical and technical foundations of X-ray and ultrasound, CT research.
3	Physical and technical foundations of radionuclide and MRI research.
4	Radiological research methods and radiological anatomy of chest cavity organs.
5	Basics of radiation semiotics of the pathology of the chest cavity.
6	Radiological research methods and radiological anatomy of abdominal organs. Basics of radiation semiotics of the pathology of abdominal organs.
7	Radiological signs of diseases of the kidneys and urinary tract.
8	Radiation signs of diseases of the musculoskeletal system.
9	X-ray diagnostics of emergency conditions.
10	Principles and methods of radiation therapy.
Hours in general	

6. Topics of practical classes

No	Topic
1	Basic properties of ionizing radiation. Biological effect of ionizing radiation on healthy and pathologically changed cells.
2	Radioactivity and dose. Dosimetry of ionizing radiation: units and methods of determining radioactivity and radiation dose.
3	Physico-technical foundations of X-ray diagnostics.
4	Physical and technical foundations of computer tomography.
5	Physical and technical foundations of radionuclide research.
6	Physical and technical foundations of magnetic resonance imaging.
7	Physical and technical foundations of ultrasound diagnostics.
8	Radiological methods of research of respiratory organs.
9	Radiation signs of inflammatory diseases of the respiratory organs.
10	Radiation signs of lung tumors.
11	Radiation methods of research of the cardiovascular system.
12	Radiation signs of diseases of the cardiovascular system.
13	Radiological methods of research of the gastrointestinal tract.
14	Radiation signs of diseases of the gastrointestinal tract.

15	Radiological research methods and radiological anatomy of the hepatobiliary system.
16	Radiation signs of diseases of the hepatobiliary system.
17	Radiological research methods and radiological anatomy of the urinary system. Radiological signs of developmental abnormalities and tumors of the urinary system.
18	Radiological signs of diseases of the kidneys and urinary tract. Radiation signs of tumors of the urinary system.
19	Radiological research methods and radiological anatomy of the locomotor system. Injuries
20	Radiation signs of inflammatory diseases of the musculoskeletal system.
21	Radiological signs of tumors of the musculoskeletal system.
22	Radiological research methods and radiological anatomy of the breast. Radiation signs of breast diseases.
23	Radiation research methods and radiation anatomy of the reproductive system. Radiation signs of diseases of the reproductive system.
24	Radiation methods of research in endocrinology. Radiation signs of diseases of the thyroid gland.
25	Radiological research methods and radiological anatomy of the central nervous system. Radiation signs of diseases and injuries of the central nervous system.
26	Radiation diagnostics in oncology.
27	Radiation signs of emergency conditions.
28	Basics of radiation therapy for tumor and non-tumor diseases.
29	Radiation therapy methods: X-ray therapy; contact methods; long distance gamma therapy and radiation therapy with high energy sources.
ZO	Final control of mastering the discipline.
	Hours in general

7. Independent work

No	Topic
1	The history of the development of radiology. X-ray photography.
2	Laws of X-ray science .
3	Interventional methods of X-ray diagnostics.
4	Diagnostic capabilities of PET.
5	Indications and contraindications for MRI.
6	The principle of energy dopplerography .
7	Radiological anatomy of respiratory organs.
8	Radiological anatomy of the cardiovascular system.
9	Radiation semiotics of pulmonary tuberculosis.
10	Radiation diagnostics of emergency conditions of respiratory organs.
11	X-ray diagnostics of emergency conditions of the cardiovascular system. BODIES. Aortic aneurysm. Diagnostics. Modern methods of treatment.
12	Basics of radiation semiotics of the pathology of abdominal organs. Radiation signs of diseases of the gastrointestinal tract.
13	Radiation diagnosis of peptic ulcer complications.
14	Tactics of radiation examination and radiation semiotics of gallstone disease.
15	Modern methods of treatment of diseases of the pancreas and bile

	stone disease.
16	Tactics of radiation examination and radiation semiotics of urolithiasis.
17	Ultrasound method in the diagnosis and treatment of urolithiasis.
18	Tactics of radiation examination in "acute abdomen" syndrome. Intestinal obstruction.
19	Radiological signs of traumatic injuries of the locomotor system.
20	X-ray diagnostics of diseases of the spine and damage to the joints in rheumatoid arthritis, deforming osteoarthritis, collagenoses.
21	X-ray diagnosis of hip dysplasia, anomalies of bone development. Rickets-like diseases.
22	Radiation diagnosis of breast cancer.
23	Radiation diagnosis of thyroid cancer.
24	Radiation diagnosis of strokes. Endovascular (X-ray-operative) methods of treatment of strokes and heart attacks.
25	Endovascular methods of treatment of diseases of the genital area.
Hours in general	

8. Individual tasks

Not provided.

9. Teaching methods

Practical classes: conversation, consideration of presentations on the topics of practical classes, solution of clinical situational problems, examination of an X-ray diagnostic tube, practicing the skills of describing X-ray images, instruction and practicing the skills of working with medical programs in the DICOM format, visiting the X-ray diagnostic, CT and X-ray therapy departments, demonstrating and practicing skills performing manipulations according to list 5.

Independent work: independent work with a textbook, independent work with X-ray archive of the department, independent solution of clinical tasks.

10. Control methods and criteria for evaluating learning results **Current control:** oral survey, testing, evaluation of practical skills, solution of situational clinical tasks, evaluation of activity in class. **Final control:** diff. assessment, testing.

The structure of the current evaluation in the practical lesson :

1. Evaluation of theoretical knowledge on the subject of the lesson:
methods: survey, solving a situational clinical problem; maximum score - 5, minimum score - 3, unsatisfactory score - 2.
2. Evaluation of practical skills and manipulations on the topic of the lesson:
methods: evaluation of the correctness of the implementation of practical skills, maximum score - 5, minimum score - 3, unsatisfactory score - 2;
3. Evaluation of work with a patient on the subject of the lesson:
methods: assessment of: a) communication skills of communicating with the patient and his parents, b) the correctness of prescribing and evaluating laboratory and instrumental studies, c) compliance with the differential diagnosis algorithm, d) substantiation of the clinical diagnosis, e) drawing up a treatment plan
- maximum score - 5, minimum score - 3, unsatisfactory score - 2;

Current assessment criteria for practical training:

"5 »	The student is fluent in the material, takes an active part in discussing and solving a situational clinical problem, confidently demonstrates practical skills when examining radiographs and interpreting clinical, laboratory and instrumental research data, expresses his opinion on the subject of the lesson, demonstrates clinical thinking.
"4 »	The student has a good command of the material, takes part in the discussion and solution of a situational clinical problem, demonstrates practical skills during the analysis of radiographs and the interpretation of clinical, laboratory and instrumental research data with some errors, expresses his opinion on 3 topics of the class, demonstrates clinical thinking.
"3 »	The student does not have sufficient knowledge of the material, takes part in the discussion and solution of a situational clinical problem without confidence, demonstrates practical skills during the analysis of radiographs and the interpretation of clinical, laboratory and instrumental research data with significant errors.
"2 »	The student does not master the material, does not take part in the discussion and solution of the situational clinical problem, does not demonstrate practical skills during the analysis of radiographs and the interpretation of clinical, laboratory and instrumental research data.

The student is admitted to the final control of learning the discipline (different credit) on the condition that the requirements of the educational program are met and if he received at least 3.00 points for the current educational activity, has no missed lectures and practical classes, successfully completed an essay and a presentation with topics of students' independent work (SRS).

The structure of the final control of mastering the discipline

The content of the evaluated activity	Number
Independent description of three x-ray studies from three different systems (for example, bone, thoracic organs, central nervous system).	3
Answer to 2 (two) theoretical questions.	2

Criteria for evaluating the learning outcomes of education seekers in the exam:

"5 »	It is issued to a student who worked systematically during the semester, showed during the diff. versatile and in-depth knowledge of the program material, able to successfully perform the tasks provided for by the program, mastered the content of the main and additional literature, realized the interrelationship of individual sections of the discipline, their importance for the future profession, showed creative abilities in understanding and using the educational program material, demonstrated the ability to independently update and replenish knowledge; level of competence - high (creative);
"4 »	It is awarded to a student who has demonstrated complete knowledge of the curriculum material, successfully completes the tasks provided for by the program, has mastered the basic literature recommended by the program, has shown a sufficient level of knowledge in the discipline and is capable of their independent updating and renewal in the course of further education and professional activity; the level of competence is sufficient (constructive and variable);
"3 »	It is presented to a student who has demonstrated knowledge of the main curriculum material in the amount necessary for further education and subsequent work in the profession, copes with the tasks provided for in the program, has made individual mistakes in answers to the diff. credit and when performing exams

	tasks, but has the necessary knowledge to overcome the mistakes made under the guidance of a scientific and pedagogical worker; level of competence - average (reproductive);
"2" »	It is issued to a student who has not demonstrated sufficient knowledge of the main curriculum material, has made fundamental mistakes in completing the tasks provided for by the program, cannot use the knowledge in further studies without the help of a teacher, has not managed to master the skills of independent work; the level of competence is low (receptive -productive).

A student who has systematically worked during the academic year and has an average score of 4.75 or higher receives 5.00 points without a test during the diff . offset About the possibility and conditions of obtaining a diff . the teacher informs all students of the group "automatically" of the score at the first lesson.

11. Distribution of points received by students of higher education The grade for the discipline consists of 50.0% of the grade for the current academic performance and 50.0% of the grade for the exam.

The average score for the discipline is translated into a national score and converted into points on a multi-point scale.

Table of conversion of a traditional assessment into a multi-point assessment:

National assessment for discipline	The sum of points for the discipline
"5"	180-200
"4"	150 -179
"3"	120 -129

Conversion of the traditional grade from the discipline and the sum of points on the ECTS scale

Evaluation on the ECTS scale	Statistical indicator
A	The best 10% of students
B	The next 25% of students
C	The next 30% are students
D	The next 25% of students
E	The next 10% of students

12. List of questions to the diff . offset

1. X-ray research methods.
2. Basics of x-ray semiotics of the pathology of various organs and systems.
3. Radionuclide research methods.
4. Basics of radionuclide semiotics of pathology of various organs and systems.
5. Ultrasonic research methods.
6. Fundamentals of ultrasound semiotics of the pathology of various organs and systems.
7. Magnetic resonance research methods.
8. Basics of MPT - semiotics of pathology of various organs and systems.

9. Radiological research methods, radiological anatomy of the lungs and mediastinum .
10. X-ray semiotics of lung and mediastinal diseases.
11. Leading X-ray syndromes of lung and mediastinal pathology and their morphological substrate.
12. Radionuclide, ultrasound, magnetic resonance and tomographic semiotics of lung and mediastinal diseases.
13. Leading radionuclide, ultrasound, magnetic resonance tomographic syndromes of lung and mediastinal diseases and their morphological substrate.
14. Radiographic research methods and radiographic anatomy of the heart and blood vessels.
15. X-ray semiotics of diseases of the heart and large vessels.
16. Leading x-ray syndromes of the pathology of the cardiovascular system and their morphological substrate.
17. Ultrasound, radionuclide, magnetic resonance and tomographic semiotics of diseases of the cardiovascular system.
18. Conductive ultrasound, radionuclide, MPT syndromes of heart and vascular pathology and their morphological substrate.
19. Methods of X-ray research of the gastrointestinal tract. Advantages and disadvantages of each of the methods. The expediency of choosing a technique in different clinical circumstances.
20. Radiological anatomy of the gastrointestinal tract.
21. Leading X-ray syndromes of the pathology of organs of the digestive tract.
22. X-ray semiotics of diseases of the digestive tract.
23. Possibilities of radiation assessment of physiological disorders of the digestive tract. Methods. Symptoms
24. Radiological research methods and radiological anatomy of the hepatobiliary system.
25. Segmental structure of the liver. Features of liver blood supply. Radial possibilities of its visualization.
26. X-ray semiotics of diseases of organs of the hepatobiliary system.
27. Morphological substrate of pathological changes of the hepatobiliary system.
28. Ultrasound, radionuclide, magnetic resonance and tomographic semiotics of diseases of organs of the hepatobiliary system.
29. Leading ultrasound, radionuclide, magnetic resonance tomographic syndromes of pathology of the liver, gall bladder, biliary tract and their morphological substrate. The expediency of the purpose of each of the methods in comparison.
30. Radiological research methods and radiological anatomy of the urinary system.
31. Defects in the development of the urinary system. Features of their detection by various methods.
32. X-ray semiotics of diseases of the organs of the urinary system.
33. Leading X-ray syndromes of urinary system pathology, their morphological substrate.
34. Ultrasound, radionuclide, CT and MRI semiotics of diseases of the urinary system.
35. Conductive ultrasound, radionuclide, magnetic resonance and tomographic syndromes of the pathology of the urinary system, their morphological substrate.
36. Methods of radiation research and radiation anatomy of the male and female reproductive system.
37. Modern possibilities of radiation multimodal research of the reproductive system.
38. Visualization of malformations of the reproductive system of men and women.
39. Radiation signs of tumors of the reproductive system of men and women.
40. Radiological anatomy of the breast. Developmental defects.
41. Radiation semiotics of breast diseases.

42. Leading radiation syndromes of breast pathology, their morphological substrate.
43. Radiological research methods and radiological anatomy of bones and joints.
44. Synostosis, syndesmosis and joint in the radiographic image.
45. X-ray semiotics of traumatic injuries of bones and joints.
46. X-ray signs of reparative phenomena of traumatic injuries of bones and joints.
47. X-ray semiotics of complications of traumatic injuries of bones and joints.
48. X-ray semiotics of bone and joint diseases.
49. Leading X-ray syndromes of pathology of bones and joints, their morphological substrate.
50. Radionuclide, ultrasound, CT and MRI semiotics of bone and joint diseases. Advantages and disadvantages of each of the methods.
51. Leading radionuclide, ultrasound, CT and MRI syndromes of bone and joint pathology, their morphological substrate.
52. Radiological research methods and radiological anatomy of the brain and spinal cord.
53. Malformations of the central nervous system and their visualization.
54. CNS injury. Algorithms for examining a patient with a CNS injury.
55. Early symptoms of ischemic and hemorrhagic strokes. Patient examination tactics in the reception department.
56. Methods of radiation research of the thyroid gland.
57. Radiological anatomy of the thyroid gland. Embryonic tract of movement of the thyroid gland. Location of malformations of the thyroid gland.
58. Radiation semiotics of thyroid pathology.
59. Leading syndromes of thyroid pathology, their morphological substrate.
60. Radial semiotics of emergency conditions.
61. Conductive radiation syndromes of emergency conditions.
62. Algorithms for examination of a patient with polytrauma in the reception department.
63. Morphological substrate of emergency conditions. Possibilities of assessing the severity and predicting the development of complications.
64. The expediency of using various radiological methods of diagnosing emergency conditions in various clinical situations.
65. Ways to protect patients and medical institution personnel from ionizing radiation during radiation examination.
66. Protective measures to reduce doses of ionizing radiation during radiation examination.
67. Types of contrast substances used in X-ray, CT, ultrasound and MRI studies.
68. Organization of preventive examinations of the population (FGD, mammographic screening). Disadvantages and advantages.

13. Methodological support:

Work program of the academic discipline

Syllabus of the academic discipline

Textbooks:

1. Kovalsky O. V. Radiology. Radiation therapy. X-ray diagnostics: tutorial. for studies _ higher _ honey. teach _ app. IV level of accreditation / O. V. Kovalskyi, D. S. Mechev, V. P. Danylevich. - 2nd edition. - Vinnytsia: New book, 2017. - 512 p. Radiology (ray diagnostics and radiation therapy). Kyiv, Book plus, 2013. -743 p.

2. Radiology (radiodiagnosis and radiation therapy). Test tasks. Part 1. Kyiv, Book plus. 2015. -104 p.
3. Radiology (radiodiagnosis and radiation therapy). Test tasks. Part 2. Kyiv, Book plus. 2015. -168 p.
4. Radiology (radiodiagnosis and radiation therapy). Test tasks. Part 3. Kyiv, Book plus. 2015. -248 p.

Multimedia presentations

Cathedral archive of radiographs in analog and electronic form. Methodical development of practical classes.

Electronic bank of test tasks by subdivisions of the discipline.

14. Recommended literature

Main:

1. Kovalsky O. V. Radiology. Radiation therapy. X-ray diagnostics: tutorial . for studies _ higher _ honey. teach _ app . IV level of accreditation / O. V. Kovalskyi, D. S. Mechev , V. P. Danylevich. - 2nd edition. - Vinnytsia: New Book, 2017. - 512 p. Radiology (ray diagnostics and radiation therapy). Kyiv, Book plus, 2013. -743 p.
2. Radiology (radiodiagnosis and radiation therapy). Test tasks. Part 1. Kyiv, Book plus. 2015. -104 p.
3. Radiology (radiodiagnosis and radiation therapy). Test tasks. Part 2. Kyiv, Book plus. 2015. -168 p.
4. Radiology (radiodiagnosis and radiation therapy). Test tasks. Part 3. Kyiv, Book plus. 2015. -248 p.
5. Radiodiagnostic methods Training manual (Department of Medical Research Protocol No. 5 dated 05.25.17) N.V. Tumanska , K.S. Barska. 143 p
6. Radiology. Educational and methodological complex of the educational discipline "Radiology" for students of the III year of the I and II medical faculty of VNMZ educationally - qualification level "specialist" direction 1201 "Medicine" specialty 7.12010001 "Medical business", 7.12010002 "Pediatrics" / N.V. Tumanska , S.O. Myagkov , O.G. Nordio ., T.M. Kichangina - Zaporizhzhia: ZDMU, 2018. - 153 p.
7. Radiology Kovalsky O. V. Radiology. Radiation therapy. X-ray diagnostics: tutorial . for studies _ higher _ honey. teach _ app . IV level of accreditation / O. V. Kovalskyi, D. S. Mechev , V. P. Danylevich. - 2nd edition. - Vinnytsia: New Book, 2017. - 512 p.

Additional literature

8. Radiation medicine: Textbook for medical universities 3-4 years.ac. approved by the Ministry of Education and Culture . E. Pylypenka -K., 2013, 232 p., ed. "Medicine".
9. Radiation medicina = Radiation medicine Textbook for medical universities 3-4 years.ac. approved by the Ministry of Education and Culture . E. Pylypenka -K., 2013, 232 p., ed. "Medicine".
10. Tomographic methods of radiation diagnostics. Study guide (Department of Medical Research Protocol No. 5 dated 05.25.17) N.V. Tumanska , K.S. Barska, I.P. Jos , 91 p.
11. Radiology. Radiotherapy. Diagnostic imaging= Radiology. Radiation therapy. X-ray diagnostics. Type 2. Textbook for the 4th year of the VMNS. ac . recommended by the Ministry of Health, edited by O.V. Kovalsky, edition "New book", 512 p.
12. Myagkov O.P., Myagkov S.O. Atlas of radiation diagnostics of tumors of bones and soft tissues. - Zaporizhzhia. - Shamrai G.S. - 2017. - 296 p.
13. Collection of test tasks in radiology for practical classes of module 1 "Fundamentals, principles and methods of radiology" and final module control for students From the course of medical faculties Visual guide to practical classes in radiology

for students of the 3rd year of medicine of x faculties. - Zaporizhzhia: 1 1 1 1 153 ZDMU,²
2015. - 74 pp. N.V. Tumanska, K.S. Barska approved by the Central Methodological
14. Clinical Radiology The Essentials Fourth Edition by Daffner MDACR, Dr.
Richard EL, Hartman MD, Dr. Ma (2014) - 4th edition. 2014 546p.
15. OSPU-2000. NRB 1998.
16. Order No. 51/151 dated February 16, 2017 , on the approval of the General Rules of
Radiation Safety.

Approved:



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