Grodno State Medical University

Radiology and radiotherapy

The educational program for the speciality General Medicine for faculty of foreign students

Faculty: foreign students

Department of oncology with course of radiology and radiotherapy

Year: 3

Semester: 5, 6

Lectures 20 hrs Exam -

Practice (seminar) classes 54 hrs Offset 5, 6 semester

Laboratory classes - Course project -

Total class hours in discipline 74

Total hours In discipline 114 Form of high education - fulltime

Compiler lecturer Auchinikau U.A.

2010

The curriculum is based on the electronic version of a model curriculum for radiology and radiotherapy, developed at the "Belarusian State Medical University", 2010

Reviewed and recommended for approval at the meeting of the oncology department with course of radiology and radiotherapy (15.06. 2010, protocol № 10)

Head of the Department of Oncology
with course of radiology
and radiotherapy
professor  K.N.Uglyanitsa

EXPLANATORY NOTE

Radiology and radiotherapy – the discipline, which contains systematized scientific knowledge and methods of radiology and radiotherapy in clinical medicine.

In our days radiology and radiotherapy are the different divisions of medicine. Radiology allow to detect pathogenesis and another important characteristics of pathological processes, and fix it as objective documentation. Radiotherapy is one of the main methods with surgery and chemotherapy of treatment in oncological practice.

Study of the subject "Radiology and radiotherapy" is based on the previous knowledge of normal and pathological anatomy, physiology, biophysics, biology, histology, chemistry, radiation medicine.

Knowledge and skills obtained in the discipline, supplemented by subsequent courses of internal medicine, surgery, oncology, neurology, pediatrics, obstetrics and gynecology.

Purposes and objectives of discipline

Purpose: formation of the student's knowledge and skills for the integrated use of modern methods of radiation imaging with the recognition of the most common diseases in clinical practice and radiation therapy in the treatment of neoplastic and non-neoplastic diseases.

Objectives:

The tasks of the discipline is to acquire the student's academic competence, which was based on the ability to self-search training and information resources, mastery and understanding of the methods of acquiring knowledge:

- organic-integrated use in clinical medicine ray imaging methods for detecting disease in different age groups

Task of teaching the subject aimed at developing the students' social and personal and professional competence, subject to the rules of medical ethics and deontology, the foundation of which is to know:

pathological changes in the organs and systems of rights and the relationship of the complex syndrome with a specific disease;

- strategies for radiation therapy of malignant tumors and benign diseases.

Requirements for the mastering the discipline

Student should **know:**

- the system of protection of radioprotective and safety in diagnostic and therapeutic uses of radiation;
- biophysical properties, radiosensitivity and radioresistance tissues and organs;
- the types of electromagnetic, ultrasonic, and corpuscular radiation used in X-ray diagnostics;
- basic and special imaging techniques in X-ray diagnostics, the system of generation and transmission of digital images;
- the basis of organic and integrated use of modern visualization methods and radiation therapy;

Student should **be able:**

- explain the result of radiation research at the most common diseases of the lungs, heart, esophagus, stomach, intestine, gall bladder, kidneys, endocrine system, bones and joints.

Study of the subject "Radiology and Radiation Therapy" is held on the 3rd year (5th and 6th semester). Classroom hours - 74, including lectures - 20 -54 and practical. A total of 114 training hours. The shape of the current certification - differentiated offset in V and VI semesters.

CONTENT OF THE MATERIAL

1. RADIOTHERAPY

1.1. Introduction to radiology. Physical and biological bases of Radiology and Radiotherapy

Introduction to radiology and radiotherapy. A short history of radiology. Definition of medical radiology as a discipline. Place of radiology and radiotherapy in combination of medical knowledge and its relation to other sciences. Discovery of natural and artificial radioactivity. Using of ionizing radiation sources in the economy. The nature and properties of ionizing radiation. The interaction of ionizing radiation with matter. The phenomenon of radioactivity. The law of radioactive decay. Types of decays. Radiation and the sources used in medicine, their nature and properties. Quality characteristics of ionizing radiation used in medicine. Foundations and principles of dosimetry. The concept of dose. Objectives and methods of dosimetry. The main types of radiation-monitoring equipment. System units of dose, dose rate and radioactivity

1.2. Basics and principles of radiotherapy

Biological basis of radiotherapy - the ability of ionizing radiation to cause changes in cells, tissues, organs and the body. Indications for radiotherapy. Absolute and relative contraindications for radiotherapy. Radiosensitivity of normal and malignant cells. Classification of malignant tumors in the WHO International Classification of TNM. The absorption of the radiation energy and the primary radiation-chemical reaction. Radiation effect on the tumor. Radiobiological background radiation therapy of malignant tumors. Planning of radiotherapy. Select the type of radiation treatment and definition of treatment methods. Selection of the optimal dose of radiation exposure and rhythms. Determination of the topography of the tumor. Clinical topometry in preparing patients to radiation and monitoring its implementation. Basic principles of clinical topometry.

Determination methods of exposure. Postradiation period. Management radiosensitivity of tumor and normal tissues. Using of hypoxic mixtures. The combination of hyperthermia and radiation exposure. Indications and contraindications for radiotherapy of benign processes. The principles of radiation therapy benign diseases.

1.3. Methods of radiotherapy of malignant tumors and benign diseases

Technical facilities for the treatment of patients. Settings for remote exposure (linear and circular accelerators, gamma and X-ray devices). General characteristics of the methods of exposure. Remote and contact methods of exposure. Applique, intracavitary and interstitial techniques. Methods and techniques of radiation dosimetry with justification. Preparation of patients to irradiation. Structure and equipping of radiotherapy. Features of the device and the organization of work in the department of radiotherapy. Premises, facilities and equipment providing radiation safety for personnel. Treatment options for cancer patients.

2. RADIOLOGY

2.1 Principles and methods of radiology. Role and tasks of radiology clinical research in patients

2.1.1. Methods of X-ray examinations.

X-rays of his opportunities in the modern clinic. The principle of X-ray imaging. Characteristic X-ray image (his summary character, contrast, sharpness). Value omni radiological examination. Basic and special X-ray techniques (radiography, fluoroscopy, fluorography, digital radiography, linear tomography, etc.). Methods of artificial contrast in radiology. Types of contrast agents. The principles and foundations of computer (X-ray) imaging. Features images of CT scan. Densitometry computer X-ray images

Interventional radiology. The main directions of interventional radiology: endovascular (dilatation, embolization, cava-filter installation, etc.), endobronchial, endobiliary, endoureteral, endoesophageal, percutaneous drainage of cysts and abscesses. Therapeutic endovascular interventions of thoracic and abdominal cavities and the retroperitoneal space (dilatation of stenotic segments, stone removal, drainage of abscesses, biliary decompression and drainage of the bile ducts).

Organization of X-ray department. X-ray equipment. The main types of X-ray systems. Demonstration of the basic types of X-ray systems

2.1.2. Principles and basics of the ultrasonic diagnostic examination. Ultrasound techniques: mono-dimensional study (ultrasound), 2-dimensional study (ultrasound, scan) and Doppler. Contrast agents in ultrasound diagnosis. Visualization of organs and tissues. Key terms of research, is used to describe echo-negative and echo-positive site, acoustic shadow.

Priority of use. Limitations of method.

2.1.3. Principles and basics of magnetic resonance imaging.

Magnetic resonance imaging. The phenomenon of nuclear magnetic resonance. Principles for the use in the diagnosis - the ability of the nuclei of certain atoms to behave as magnetic dipoles. Selective (resonant) absorption of electromagnetic energy. Registration of the magnetic signal, contrast agents in magnetic resonance imaging. Magnetic resonance spectroscopy. Features of images of organs and tissues in the magnetic resonance image. Advantages and disadvantages of the method.

2.2. Principles and foundations of nuclear medicine.

Basics and principles of nuclear medicine. Requirements for radiopharmaceuticals. Radiodiagnostic equipment (detectors of radiodiagnostic appliances, electronics, output control device). Radiometers. Radiography. Scanners. Gamma camera. Radionuclide emission tomography. Studies in vitro and in vivo. Dynamic and static methods of nuclear medicine. The assessment function and morphology of the body to the radionuclide study possibilities of positron emission tomography, single photon emission computed tomography.

Common and local radiation reactions and damage. The biological effect of low doses of ionizing radiation. The dose limit and categories of examined patients. "Critical" internals and doses during radiodiagnostic studies. Principles of anti-radiation protection and safety measures for the diagnostic use of radiation Regulation of ray diagnostic examinations. Safety in radiologic and radionuclide departments. Protection rules when working in the field of ionizing radiation. Dose monitoring.

2.3. Diagnostics and semiotics of injuries and diseases of the musculoskeletal system

2.3.1. Study of osteoarticular apparatus. Semiotics of pathological processes.

Radiological anatomy of the skeleton. Methods of radiation research. Radiological anatomy of normal bones and joints. Age features of the bones and joints. Radiological symptoms and syndromes of injuries and diseases of the skeleton. Changing the shape of the bones (distortion, deformation of the articular surfaces of bones, local growths in the bones). Change in bone (bone enlargement and hypertrophy - hyperostosis, reduced bone - atrophy). Change in bone structure (osteoporosis, osteosclerosis, osteolysis, destruction, sequestration, periostitis). Changing the X-ray of the joint space (expansion, uniform and non-uniform narrowing the gap)

Essence, the possibilities and indications for radionuclide diagnosis of bone tumors.

2.3.2. Radiological signs of injuries and diseases of the musculoskeletal system.

Radiological signs of injury musculoskeletal: sprains, fractures, complications and their healing. Radiographic manifestation injuries of the musculoskeletal system - sprains, fractures and signs of healing. Age features of fractures. Fractures in childhood (subperiosteal fracture).

Radiographic diagnosis of diseases of bones and joints. X-ray diagnosis of osteomyelitis, tuberculosis, tumors, degenerative and systemic diseases. Joint diseases. Bone tumors. Benign tumors. Spongy and compact osteoma osteochondroma chondroma primary malignant tumor. Periosteal fibrosarcoma. Osteogenic sarcoma (osteolytic, osteoblastic and mixed). Ewing's tumor. Plasmacytoma. Secondary (metastatic) malignant bone tumors. Osteolytic and osteoblastic metastases. Developmental abnormalities of the musculoskeletal system in children.

2.4. Radiological diagnostics and specific features of pathological symptoms of lung X-ray examination

2.4.1 Radiological examination of the respiratory system. Semiotics of pulmonary diseases.

Radiologic study of respiratory system. X-ray technique (fluoroscopy, fluorography, radiography, tomography, bronchography). The major radiographic lung disease syndromes. Method of analysis of chest radiographs. Radiological normal anatomy of the chest. The major radiographic lung disease syndromes: an extensive and limited dimming pulmonary field, circular or ring-shaped shadow in the lung field, pulmonary dissemination, pathological changes of the root and pulmonary pattern, disturbance of bronchial obstruction.

2.4.2. Diseases and injuries of the respiratory system

X-ray picture of acute pneumonia, hydrothorax, pneumothorax, tumors, tuberculosis. Obstructive hypoventilation, emphysema and atelectasis. Radiological pattern of enlarged lymph nodes in hilar zone, and mediastinum. Emergency X-ray diagnosis of foreign bodies of the trachea and bronchial tubes, pulmonary artery thromboembolism, pulmonary edema.

2.5. Radiological examination of the heart and vessels

2.5.1. Radiological examination of the heart and blood vessels.

Invasive and noninvasive radiological examination of the circulatory system: X-ray, angiocardiography, aortography, arteriography, venography, nuclear medicine studies. Ultrasound, magnetic resonance imaging. Radiological anatomy of the heart and great vessels in the normal analysis of the arcs of the heart. Possibility of

radiological methods in the evaluation of morphological and functional state of hemodynamics. Examination of lymph nodes.

2.52. Radiological diagnosis of cardiovascular disease.

Radiological pattern of ischemic heart disease, hypertrophic cardiomyopathy, pericarditis, mitral stenosis, mitral valve insufficiency, aortic stenosis, aortic valve insufficiency, aneurysms of the thoracic aorta, atrial septal defect and ventricular septal defect, open arterial duct, coarctation of the aorta, pulmonary artery stenosis , tetralogy of Fallot.

2.6. Radiological diagnosis of diseases of the gastrointestinal tract, additional digestive organs and genito-urinary system

2.6.1. Radiological diagnosis of diseases of the gastrointestinal tract.

Methods of X-ray examination of the esophagus, stomach, duodenum, small and large intestines. Radiological anatomy of the gastrointestinal tract. The main radiological signs of pathological changes of the esophagus, stomach, duodenum, small and large intestine. X-ray signs of ulcers, polyps and cancer of the stomach. Emergency X-ray diagnosis of esophageal foreign bodies. The main X-ray signs of congenital and acquired abnormalities of the esophagus (diverticulum, burn, achalasia and neoplastic disease). X-ray diagnosis of gastric ulcer complications: perforation, penetration, malignancy, and stenosis of the stomach, cicatricial deformation, bleeding. X-ray picture of acute intestinal obstruction. X-ray signs of enteritis, diverticulitis, colitis and colon cancer.

2.6.2. Radiologic diagnosis of diseases of the liver and pancreas.

Radiologic examination of the liver, bile ducts and pancreas: cholecystography, cholangiography, operating cholangiography, endoscopic retrograde cholangiopancreatography , ultrasound, CT and magnetic resonance imaging. The value of nuclear medicine techniques in the study of functional and morphological state of the liver. Indications and contraindications for study. Preparing the patient for examination. Static and dynamic scintigraphy of the liver. Limits and possibilities of nuclear medicine liver. Radiological pattern in traumatic injuries of the liver, hepatitis, cirrhosis, gallstones, acute cholecystitis, tumors, ascites, obstruction of bile ducts. Radiological pattern of acute and chronic pancreatitis, tumors, stones.

2.6.3. Radiological diagnosis of diseases of the genitourinary system.

Methods of investigation and normal appearances. Radiologic studies (plain film, excretory urography, retrograde pyelography, cystography,angiography of the kidneys). Ultrasound of the kidneys, computed tomography, magnetic resonance imaging. The value of nuclear medicine techniques in the study of functional and morphological state of the kidneys. Indications and contraindications for study. Preparing the patient for examination. Static and dynamic renal scintigraphy. The value of these methods in the evaluation of the morphology and function of the urinary system. Radiological pattern of traumatic injuries and diseases of urinary system: glomerulonephritis, pyelonephritis, abscess, tuberculosis, pyonephrosis, renal stone disease, nephrosclerosis, tumors and cysts. Anomalies number, position and relative position of the kidneys. Methods of investigation of the female reproductive system: ultrasound (sonography), computed and magnetic resonance imaging. Mammography.

2.7. The additional affairs nuclear medicine

2.7.1. Nuclear medicine and radiological imaging for investigation of the endocrine system.

Various imaging modalities of pituitary, adrenal, thyroid and parathyroid glands. Their radiological anatomy, physiology and pathology datas. The value of nuclear medicine techniques in the study of thyroid gland. Indications and contraindications for nuclear medicine examinations. Preparing the patient for examination. Principle study iodine metabolism in the body. Possibility of nuclear medicine methods for investigation of the thyroid gland. Radiological pattern in diseases of pituitary, adrenal, thyroid and parathyroid glands: cancer, inflammatory diseases. Developmental abnormalities of the thyroid gland.

2.7.2. Nuclear medicine and radiological imaging for investigation of the nervous system.

Role of nuclear medicine techniques in the study of the central nervous system. Methods of radiological examination and normal appearance of skull, spine, brain and the spinal cord. Radiological pattern in injuries and diseases of the skull and the brain: traumatic injuries, cerebral circulatory disorders, tumors, inflammatory and degenerative diseases. Radiological pattern in traumatic injuries, tumors, inflammatory and degenerative diseases of the spine and spinal cord, abnormal development of the brain.

INFORMATIONAL PART

Literature

Main:

1. Auchynicau, U. Radiology and radiation therapy. Textbook for the third year students of medical university / U. Auchynicau. – Grodno: GrSMU, 2011. – p. 306.
2. Васильев, А.Ю. Лучевая диагностика: учебник для студентов медицинских вузов. – М.: ГЭОТАР-Медиа, 2008. – 688.
3. Линденбратен, Л.Д. Медицинская радиология (основы лучевой диагностики и лучевой терапии) / Л.Д. Линденбратен, И.П. Королюк. – М.: Медицина, 2000. – 672 с.
4. Лучевая диагностика: учебник. Т.1. / под ред. Труфанова Г.Е. − М.: ГЭОТАР-Медиа, 2007. − 416 с.
5. Труфанов, Г.Е. Лучевая терапия: учебник, Т.2. / Г.Е. Труфанов, М.А. Асатурян, Г.М. Жаринов. − М.: ГЭОТАР-Медиа, 2007. − 192 с.

Additional:

1. Daffner, R. Clinical Radiology / R.Daffner // – Baltimore. – Williams Wilkins. – 1993. – 391 p.
2. Sutton, D. Textbook of Radiology and Imaging (seventh edition) Vol. 1,2 // D. Sutton. –Edinburgh: Churchill Livingstone, 2003. – 1856 p.
3. Атлас рентгенодиагностический / А.В. Руцкий, А.Н. Михайлов. – Мн.: Вышэйшая школа, Т. 1, Т. 2, 1987. – 110 с.
4. Кишковский, А.Н. Неотложная рентгенодиагностика. Руководство для врачей / А.Н. Кишковский, Л.А. Тютин. – М.: Медицина, 1989. – 462 с.
5. Линденбратен, Л.Д. Медицинская радиология (Основы лучевой диагностики и лучевой терапии) / Л.Д. Линденбратен, И.П. Королюк. – М.: Медицина, 1993. – 358 с.
6. Лучевая терапия злокачественных опухолей. Руководство для врачей / Е.С. Киселева, Г.В. Голдобенко, В.С. Канаев и др; под ред. Е.С. Киселевой. – М.: Медицина, 1996.− 464 с.
7. Овчинников, В.А. Лучевая диагностика и лучевая терапия: учеб. пособие / В.А. Овчинников, В.Н. Волков − Гродно: ГрГМУ, 2009. − 415 с.
8. Рабкин, И.Х. Рентгеноэндоваскулярная хирургия / И.Х. Рабкин, А.Л. Матевосов, Л.Н. Готман. – М.: Медицина, 1987. – 270 с.
9. Руководство в пяти томах по клинической рентгенорадиологии / под ред. Г.А. Зедгенидзе. – М.: Медицина, 1985. – 305 с.
10. Руководство по медицинской визуализации / под ред. А.Н. Михайлова. – Мн.: Вышэйшая школа, 1996. – 487 с.
11. Энциклопедия рентгенологическая. Справ. врача рентгенолога и рентгенолаборанта / под ред. А.Н. Михайлова. – Мн.: Бел. навука, 2004. – 591 с.

Training and controlling software «Libra» by X-ray diagnostics and radiotherapy.

Иллюстрации к к курсу лекций по лучевой диагностике и лучевой терапии. (Электронный ресурс CD-ROM), - Гродно: ГрМУ, 2008.

The list of lectures

№	Topic of lecture	Classroom hours
1	Introduction to radiology. Physical and biological bases of radiotherapy	2
2	Principles and methods of radiotherapy	2
3	Principles and methods of radiology	2
4	Principles and basics of nuclear medicine	2
5	Radiological diagnosis of injuries and diseases of skeletal system	2
6	Radiological diagnosis of diseases of lungs	2
7	Radiological diagnosis of diseases of cardiac system	2
8	Radiological diagnosis of diseases of digestive system.	2
9	Radiological diagnosis of diseases of urinary system	2
10	Private matters of radionuclide and complex radiology	2
	Total	**20**

List of practical classes

№	Topic of practical classes	Classroom hours
1	Introduction in radiology. Physical and biological bases of radiology and radiotherapy	3
2	Basics and principles of radiotherapy	3
3	Methods of beam therapy of tumors and nonmalignant diseases	3
4	Methods of X-ray inspections	3
5	Principles and basics of ultrasound investigation	3
6	Principles and basics of magnetic- resonant tomography	3
7	Principles and basics of radionuclide diagnostic	3
8	Musculoskeletal imaging	3
9	Radiological attributes of damages and diseases of the musculoskeletal system	3
10	Pulmonary imaging. Technical and anatomic considerations.	3
11	Beam attributes of damages and the basic diseases of lungs and mediastinum	3
12	Radiological and ultrasonic researches of heart and vessels	
13	Nuclear medicine and complex radiological researches of heart and vessels	3
14	Radiological and ultrasonic researches of gastrointestinal tract and accessory digestive organs	3
15	Nucler medicine and complex beam researches of accessory digestive organs	3
16	Radiological researches in endocrinology	3
17	Radiological researches in urology and nephrology	3
18	Complex beam researches in neurology	3
	Total	**54**