

**Grodno State Medical University  
Department of Radiology and Radiotherapy**

# **GUIDELINES**

**To the practical classes in Radiology  
and Radiotherapy for the third-year international students  
in specialty “General Medicine”  
(English medium)**

Grodno, 2021

## LESSON №1

**LESSON FOCUS: introduction to Radiology. Physical and biological basics of Radiology and Radiotherapy.**

### LEARNING OUTCOME

*Students should know:*

- the types of ionizing radiations, used in medical radiology;
- processes of interaction of ionizing radiations with material;
- notion "dose" and "radio sensitivity";
- clinical dosimetry.

### SCHEDULE PLAN OF THE LESSON

1. Checking the level of theoretical knowledge of students -- 35 min.
1. Independent work of students with material for learning -55 min.
2. Discussion of the results of independent work -- 35 min.
3. Common findings on current subject - 10 min

*Place of studies: classroom in the radiological departments.*

*Duration: 3 academic hours.*

### REQUIRED THEORETICAL KNOWLEDGE

1. Nature and properties of ionizing radiations
2. Physical features of ionizing radiation. Notions of energy and the linear transfer energy of ionizing radiation.
3. Processes of interaction of ionizing radiations with material.
4. Phenomenon of radioactivity, radioactive decay law, types of decays.
5. Radiations and sources, used in medicine, their nature and properties, qualitative feature of ionizing radiations, used in medicine.
6. Basics and principles of dosimetry, notion about doses, system and stand-alone units of dose, powers of dose and radioactivity.
7. Clinical methods of dosimetry, basics types of dosimetric device.

### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Lecture material.
3. Computer presentation № 1

## LESSON № 2

**LESSON FOCUS: basics and principles of radiotherapy.**

### LEARNING OUTCOME

*Students should know:*

- biological basics and planning of radiation treatment;
- control modes radiosensitivity of tumor and normal tissues.

### SCHEDULE PLAN OF THE LESSON

2. Checking the level of theoretical knowledge of students -- 35 min.
4. Independent work of students with material for learning -55 min.
5. Discussion of the results of independent work -- 35 min.
6. Common findings on current subject - 10 min

*Place of studies: classroom in the radiological departments.*

*Duration: 3 academic hours.*

### REQUIRED THEORETICAL KNOWLEDGE

1. Biological ionizing action.
2. Notion of radiosensitivity and radiotherapeutic interval.
3. Ways of modification of radiotherapeutic interval.
4. Evidences and contraindications to undertaking of radiotherapy.
5. Preparation of sick to radiotherapy. Topometric planning. Individual anatomical card.
6. Ways of leading of dose. Notions of tolerance, cumulative radiative effect, nominal standard dose, factor "time, dose, fractionating".
7. Notions of field of irradiation, dose distribution, isodose curve.

### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Lecture material.
3. Computer presentation № 2.

## LESSON № 3

**LESSON FOCUS: methods of beam therapy of tumors and nonmalignant diseases.**

### LEARNING OUTCOME

*Students should know:*

- methods of external beam radiotherapy;
- methods of brachytherapy and lowvoltage x-ray radiotherapy;
- principles of work technical devices for radiotherapy.

### SHCEDULE PLAN OF THE LESSON

1. Checking the level of theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of the results of independent work - 35 min.
4. Common findings on current subject - 10 min

*Place of studies: classroom in the radiological departments.*

*Duration: 3 academic hours.*

### REQUIRED THEORETICAL KNOWLEDGE

1. Sources of ionizing radiation in radiotherapy.
2. External beam radiotherapy. Technical devices and variants external beam radiotherapy. Evidence.
3. Brachytherapy. Technical device after loading brachytherapy. Evidence.
4. Lowvoltage x-ray radiotherapy Technical devices for lowvoltage x-ray radiotherapy. Evidence.

### PRACTICAL SKILLS

1. Choose radiation therapy and make up a plan of treatment under supervision of the doctor.
2. To be able to determine evidences and contraindications to each technique.

### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Lecture material.
3. Computer presentation № 3.

## LESSON № 4

### LESSON FOCUS: X-ray methods.

### LEARNING OUTCOME

#### *Students should know:*

- organization of work of radiological department;
- properties of x-rays;
- X-ray methods, their classification.

#### SHCHEDULE PLAN OF THE LESSON

1. Checking the level of theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of the results of independent work -- 35 min.
4. Common findings on current subject - 10 min

*Place of studies: classroom in the radiological departments.*

*Duration: 3 academic hours.*

#### REQUIRED THEORETICAL KNOWLEDGE

1. Physical principles of reception of radiogram. Features of X-ray shadow image.
2. Methods of X-ray analysis.
3. Basics elements of X-ray machine.
4. Registration of radiograph.
5. Analysis of x-rays radiograph: definition of method and object of study, substrata of shadow and radiolucency. Computed tomography. Principle of reception of image. Device of computed tomograph.
6. Contrast agents. Classification.
7. Organization of work radiological departments.

#### PRACTICAL SKILLS

1. Recognize independently the image of all human organs on radiograph, to indicate their major anatomical structures.
2. Identify shadows and radiolucency on radiographs.
3. Define hyperdensity and hypodensity zones on computer tomography.
4. To determine hyperdensity and hypodensity zones on computer tomograms.

#### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 4.

## LESSON № 5

**LESSON FOCUS: principles and foundations of ultrasonic investigation.**

### LEARNING OUTCOME

*Students should know:*

- properties of ultrasound, used in the diagnostic;
- principle of methods of ultrasonic investigations;
- basics of analysis of images on sonogram.

### SCHEDULE PLAN OF THE LESSON

1. Checking the level of theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of the results of independent work - 35 min.
4. Common findings on current subject - 10 min

*Place of studies: classroom in the radiological departments.*

*Duration: 3 academic hours.*

### REQUIRED THEORETICAL KNOWLEDGE

1. Physical principles of reception of sonogram. Notion of echogenity.
2. Properties of ultrasound.
3. Ultrasonic diagnostic device. Basic modes of ultrasonic investigation.
4. Analysis of sonogram: definition of method and object of study, acoustic structure of test object. Contrast agents in ultrasound diagnostic.
5. Dopplerography. Variants of dopplerography.

### PRACTICAL SKILLS

1. Identify the image of organs on sonograms.
2. Identify areas of hyper- and hypoechoic.

### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 5.

## LESSON № 6

**LESSON FOCUS: principles and foundations of magnetic-resonance tomography.**

### LEARNING OUTCOME

*Students should know:*

- principles of registration of radiations in magnetic- resonant tomography;
- evidences and contraindications to these studies.

### SCHEDULE PLAN OF THE LESSON

1. Checking the level of theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of the results of independent work - 35 min.
4. Common findings on current subject - 10 min

*Place of studies: classroom in the radiological departments.*

*Duration: 3 academic hours.*

### REQUIRED THEORETICAL KNOWLEDGE

1. Phenomena of nuclear-magnetic-resonance, principles of use in the diagnostic purposes.
2. Registration of magnetic signal.
3. Magnetic- resonant spectroscopy.
4. Features of image of bodies and tissues on magnetic- resonance tomograms.
5. Advantage and lacks of method.

### PRACTICAL SKILL

1. Recognize independently the organs on the magnetic resonance image.

### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 6.

## LESSON № 7

**LESSON FOCUS: principles and foundations of nuclear medicine.**

### LEARNING OUTCOME

*Students should know:*

- principles of registration of radiations in radionuclide diagnostic;
- evidences and contraindications to radionuclide diagnostic;
- possible radiation injuries in medical radiology;
- principles of radiation safety and their realization in medical radiology.

### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students -- 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work -- 35 min.
4. Common findings on current subject - 10 min

*Place of undertaking of lesson: educational room, radiological departments.*

*Duration: 3 academic hours.*

### REQUIRED THEORETICAL KNOWLEDGE

1. Methods of nuclear medicine. Requirements for radiopharmaceuticals.
2. Nuclear medicine equipment (detectors of ionizing radiation, electronics, device control)
3. Requirement presented to radiopharmaceuticals.
4. Dynamic and static methods of radionuclide diagnostic.
5. Principle of estimation of function and morphology of organ at radionuclide study.
6. Opportunities positron emission tomography, SPECT.
7. Radiation injuries in medical radiology.
8. Principles of radiation safety and their realization in medical radiology.

### PRACTICAL SKILL

1. Recognize independently the organs on the scintigram.

### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 7.



# **QUESTIONS TO THE DIFFERENTIATED TEST ON RADIOLOGY AND RADIOTHERAPY**

**for the third-year international students (5 semestr)  
in specialty “General Medicine”  
(English medium)**

1. The properties of x-ray used for reception of x-ray images.
2. The basic methods of radiological researches. Kinds, the characteristic.
3. Conventional tomography, computerized tomography — methods of radiological researches. The characteristic.
4. Radiographic contrast agents. Indications to application.
5. Possible complications with radiographic contrast agents (principles of preventive maintenance and treatment).
6. The properties of ultrasonic wave used for reception of the ultrasonic image.
7. The basic methods of ultrasonic researches. Kinds, the characteristic.
8. Doppler method its diagnostic opportunities.
9. Reception of the ultrasonic image and its feature.
10. The kinds of radiations used in nuclear medicine.
11. Definition of radiopharmaceuticals. Requirements to radiopharmaceuticals. Ways of leading radiopharmaceuticals to object for research.
12. The basic in vivo methods of nuclear medicine.
13. The characteristic of methods static and dynamic nuclear medicine studies.
14. The characteristic of a method: radiography.
15. The characteristic of a method: fluoroscopy.
16. The characteristic of a method: a x-ray computerized tomography.
17. Principles of radiating safety in medical radiology.
18. The basic features of biological action ionizing radiations.
19. Stages of interaction ionizing radiations with cells and tissues of an organism.
20. Critical postbeam endocellular structures.
21. Critical postbeam processes in cells and tissues of an organism.
22. Kinds of fields and the wave used in a magnetic resonance imaging.
23. Principles of reception of images and its features at a magnetic resonance imaging.
24. Concept of radiosensitivity. The major factors determining radiosensitivity of a cell.
25. Ways of updating of radiosensitivity of healthy and malignant cells.
26. Linear (conventional) tomography. A principle. Opportunities. Indications.
27. External beam radiotherapy. A principle. Opportunities. Indications.
28. Brahytherapy. A principle. Opportunities. Indications. Contra-indications.
29. The combined radiotherapy. A principle. Opportunities. Indications. Contra-indications.
30. Complex radiotherapy. A principle. Opportunities. Indications. Contra-indications.
31. Radical, palliative, symptomatic radiotherapy.

32. Physical principles of protection from ionizing radiations.
33. Postbeam processes at fractionation and irradiation.
34. Sources of electromagnetic ionizing radiations for radiotherapy.
35. Sources of corpuscular ionizing radiations for radiotherapy.
36. Dosimetric rating of absorption of energy of x-ray with high energy in a body of the patient.
37. Dosimetric rating of absorption of energy of teletherapy ( $^{60}\text{Co}$ ) in a body of the patient.
38. Dosimetric rating of absorption of energy of fast electrons ( $\beta$ -rays) in a body of the patient.
39. Dosimetric rating of absorption of energy of high linear transfer energy radiations in a body of the patient.
40. Indications to radiotherapy of malignant tumours.
41. Contra-indications to radiotherapy of malignant tumours.
42. The factors determining radiosensitivity of a tumour. Radiosensitive and radioresistant tumours.
43. Modes of fractionation of doses at radiotherapy of malignant tumours.
44. Definition of biological effect of beam therapy at various fractionation of doses ( $\text{TTD}_{5/5}$ ).
45. Principles of radiotherapy of malignant tumours.
46. Postoperative radiotherapy. A principle. Indications. Contra-indications.
47. Complex radiotherapy. Variants of carrying out. Features of fractionation of doses of complex radiotherapy.
48. The basic radiological terms used in medical radiology: an equivalent dose, an effective dose.
49. The radiological terms used in radiotherapy: a dose of radiation absorbed, units of the absorbed dose and unit of a radio-activity.
50. Stochastic radiation injuries in radiology.
51. The determined radiation injuries in medical radiology.
52. The general radiation reactions at carrying out of radiotherapy (diagnostics, preventive maintenance, treatment).
53. Local radiation reactions of a skin at carrying out of radiotherapy (diagnostics, preventive maintenance, treatment).
54. Local radiation reactions of mucous membranes at carrying out of beam therapy (diagnostics, preventive maintenance, treatment).
55. Late local radiation damages (diagnostics, preventive maintenance, treatment).
56. Early local radiation damages (diagnostics, preventive maintenance, treatment).

## LESSON №8

**LESSON FOCUS: musculoskeletal imaging.**

### LEARNING OUTCOME

*Students should know:*

- opportunities of methods of beam diagnostics at research of the musculoskeletal system;
- the indication to assignment of each method of beam diagnostics at research bones and joints; contra-indication to application method of beam diagnostics at research bones and joints;
- basics of the analysis of radiographs normal bones and joints;
- basics radiological syndromes of defects of the musculoskeletal system.

### SCHEDULE PLAN OF LESSON

1. Check of a level of theoretical knowledge of students - 35 min.
2. Independent work of students with a teaching material - 55 min.
3. Discussion of results of independent work - 35 min.
4. The common conclusions on the current subject - 10 min.

*Place of carrying out of employment: an educational room, departments of radiology.*

*Study duration: 3 academic hours.*

### REQUIRED THEORETICAL KNOWLEDGE

1. X-ray, nuclear medicine, ultrasonic, magnetic resonance methods at research of musculoskeletal system.
2. The order of the analysis of x-ray film of musculoskeletal system. Age features.
3. The basics x-ray symptoms at damages of bones and joints.

### PRACTICAL SKILLS

1. To be able to prove assignment of methods of beam diagnostic bones and joints.
2. Independently to write out a direction for X-ray film, in view of concrete disease of bones and joints.

### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 8.

## LESSON №9

**LESSON FOCUS: radiological attributes of damages and diseases of the musculoskeletal system**

### LEARNING OUTCOME

*Students should know:*

- the basic radiological syndromes at traumatic, inflammatory, degenerate - dystrophic and tumoral defeats of the musculoskeletal system.

### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students -- 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work -- 35 min.
4. Common findings on current subject - 10 min.

*Place of undertaking of lesson: educational room, radiological departments.  
Duration: 3 academic hours.*

### REQUIRED THEORETICAL KNOWLEDGE

1. The basic radiological symptoms of diseases of bones and joints.
2. Radiological researches at inflammatory diseases of bones and joints.
3. Radiological researches at malignant tumours of a skeleton and soft tissues.
4. X-ray signs of a deforming arthrosis.
5. X-ray signs of an osteochondrosis of a backbone.

### PRACTICAL SKILL

1. Make a protocol of radiological image injuries and diseases of the musculoskeletal system.

### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 9.

## LESSON №10

**LESSON FOCUS: pulmonary imaging. Technical and anatomic considerations.**

### LEARNING OUTCOME

*Students should know:*

- opportunities x-rays, nuclear medicine, ultrasonic, magnetic resonance tomography methods for definition of a disease of organs of breath, anatomy and physiology of lungs.

### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students -- 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work - 35 min.
4. Common findings on current subject - 10 min.

*Place of undertaking of lesson: educational room, radiological departments.  
Duration: 3 academic hours.*

### REQUIRED THEORETICAL KNOWLEDGE

1. Plane X-ray film, fluoroscopy, a computerized tomography - opportunities, indications, contra-indications to assignment of methods.
2. Nuclear imaging (examination of pulmonary blood flow and ventilation) - opportunities, indications, contra-indications to assignment of a method.
3. Ultrasound - opportunities, indications.
4. Magnetic resonance imaging - opportunities, indications.
5. Technique of the analysis of lungs, mediastinum, diaphragm on the x-ray film.
6. Technique of the analysis of a radiolucent zones and shadows in lung.

### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 10.

## LESSON № 11

### LEASON FOCUS: radiological signs of damages and the basic diseases of lungs and mediastinum

#### LEARNING OUTCOME

##### *Students should know:*

- the basic x-ray symptoms and the syndromes a diseases of lung;
- radiological signs of the basic damages and diseases of lung and mediastinum; to be able to define on the x-ray film a damages and sharp diseases of lung.

#### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students -- 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work - 35 min.
4. Common findings on current subject - 10 min

*Place of undertaking of lesson: educational room, radiological departments.*

*Duration: 3academic hours.*

#### REQUIRED THEORETICAL KNOWLEDGE

1. The basic radiological signs at diseases and damages of lung: total or subtotal a shadow of pulmonary fields, the limited a shadow of pulmonary fields, a round a shadow in pulmonary a field, ring-shaped a shadows in pulmonary a field, the nodular shadows and their limited dissemination, diffusive dissemination in pulmonary fields, a patterns of pulmonary figure and hilar zone and bronchial lymph nodes, an extensive radiolucent of pulmonary fields.
2. The basic radiological symptoms and syndromes at inflammatory diseases of lung (a tuberculosis, pneumonia, a chronic bronchitis).
3. The central and peripheral cancer of lung.
4. Hydrothorax, Pneumothorax.
5. Diseases of mediastinum (tumors, defeats of lymph nodes).

#### PRACTICAL SKILLS

1. Identify independently the X-ray abnormalities in the lungs and make it into a research protocol.
2. Estimate independently the x-ray image and perform x-ray protocol for acute lung diseases, such as pneumothorax, pneumonia, hydrothorax.

#### LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 11.

## LESSON №12

**LESSON FOCUS: radiological and ultrasonic researches of heart and vessels.**

### LEARNING OUTCOME

*Students should know:*

- methods of radiological, ultrasonic research of heart, the central and peripheral vessels; techniques of interventional radiology, the general radiological semiotics most frequently diseases;
- to define indications and contra-indications to assignment of methods.
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### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work - 35 min.
4. Common findings on current subject - 10 mi

*Place of undertaking of lesson: educational room, radiological departments.*

*Duration: 3academic hours*

### REQUIRED THEORETICAL KNOWLEDGE

1. Methods of x-ray research of heart (standard researches; contrast researches). Indications and contra-indications.
2. X-ray anatomy and physiology of heart and large vessels.
3. Methods of radiological research of vessels (plane x-ray film; angiography). Opportunities, indications and contra-indications.
4. Methods of ultrasonic research of heart and vessels (M, B - methods, Doppler echocardiography, contrast researches). Opportunities, indications. Basics ultrasonic semiotics of diseases cardiovascular system (mitral valve and aortic valve defects; defeat of a myocardium; defeat of a pericardium; narrowing of a gleam of the central and peripheral vessels).
5. Techniques of interventional radiology (research and treatment).
6. Basics radiological semiotics of diseases of cardiovascular system (mitral, aortic defects; defeat of a myocardium; defeat of a pericardium; an atherosclerosis of an aorta and large vessels; expansion of veins).

### PRACTICAL SKILLS

1. To issue a direction to the radiologist and to carry out preparation of the patient for x-ray research.
2. To define according to the x-ray film the basic anatomic parameters of the image of heart and large vessels.
3. To define according to the x-ray film the basic pathological forms of heart and syndromes of defeat of vessels.

## **LITERATURE AND OTHERS EDUCATIONAL SOURCES**

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 12.



## LESSON №13

**LESSON FOCUS: nuclear medicine and radiological diagnosis of cardiovascular diseases.**

### LEARNING OUTCOME

*Students should know:*

- techniques of nuclear medicine researches chambers of heart, a myocardium, large and peripheral vessels;
- to choose optimum methods of beam research of heart and large vessels at a various pathology;
- to define indications and contra-indications to assignment of methods, to prove their purpose.

### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work - 35 min.
4. Common findings on current subject - 10 min.

*Place of undertaking of lesson: educational room, radiological departments.*

*Duration: 3academic hours*

### REQUIRED THEORETICAL KNOWLEDGE

1. Nuclear myocardial perfusion imaging (planar imaging and single photon emission tomography (SPECT)).
2. Positron emission tomography (PET) imaging of heart (myocardial perfusion and metabolic imaging).
3. Cardiac magnetic resonance imaging.
4. Diagnostic algorithm at defeats of heart and vessels (ischemic heart disease, myocardial infarction, mitral regurgitation, mitral stenosis, aortic stenosis, aortic valve insufficiency, aneurysms of the thoracic aorta ).
5. 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.

### PRACTICAL SKILL

To estimate the morphological and functional changes in the most common diseases of the heart with radiologist consultation or according to the protocol of radiological research.

## **LITERATURE AND OTHER EDUCATIONAL SOURCES**

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 13.

## LESSON №14

**LESSON FOCUS: radiological and ultrasonic researches of gastrointestinal tract and accessory digestive organs.**

### LEARNING OUTCOME

*Students should know:*

- methods of radiological and ultrasonic research;
- radiological and ultrasonic anatomy and physiology of gastrointestinal tract, the accessory digestive organs (the gallbladder, the liver and the pancreas);
- methods of preparation of patients, indications and contra-indications at radiological and ultrasonic research of gastrointestinal tract and accessory digestive organs.

### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work - 35 min.
4. Common findings on current subject - 10 min

*Place of undertaking of lesson: educational room, radiological departments.*

*Duration: 3 academic hours*

### REQUIRED THEORETICAL KNOWLEDGE

1. Methods of radiological and ultrasonic research of gastrointestinal tract, accessory digestive organs. Preparation, opportunities, indications and contra-indications.
2. Radiological and ultrasonic anatomy and physiology of gastrointestinal tract and accessory digestive organs.
3. Radiological semiotics of diseases of gastrointestinal tract (a ulcer, polyps, a cancer, diverticulums, inflammatory processes of an intestines, acute intestinal obstruction; perforation of gastrointestinal tract).

### PRACTICAL SKILLS

1. To perform direction to the radiologist for research of gastrointestinal tract, accessory digestive organs.
2. To distinguish on radiograph signs of perforation of gastrointestinal tract, sharp intestinal obstruction.
3. To define the basic radiological syndromes of diseases of gastrointestinal tract.

## **LITERATURE AND OTHER EDUCATIONAL SOURSES**

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 14.

## LESSON №15

**LESSON FOCUS: nuclear medicine and radiological diagnosis of accessory digestive organs.**

### LEARNING OUTCOME

***Students should know:***

methods of nuclear medicine for diagnosis of diseases gastrointestinal tract and accessory digestive organs;  
to define indications and contra-indications to them;  
to be able to choose optimum methods of beam diagnostics at most frequently diseases of gastrointestinal tract and accessory digestive organs.

### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work - 35 min.
4. Common findings on current subject - 10 min

***Place of undertaking of lesson: educational room, radiological departments.***

***Duration: 3 academic hours***

### REQUIRED THEORETICAL KNOWLEDGE

1. Methods of nuclear medicine for diagnostic used at diseases of gastrointestinal tract and accessory digestive organs (static and dynamic scintigraphy). Preparation, opportunities, indications and contra-indications.
2. Static and dynamic scintigraphy anatomy and physiology of a liver, bile ducts.
3. Radiological semiotics of diseases of digestive system (a sharp and chronic pancreatitis; cholecystitis, cholelithiasis, a cirrhosis of a liver, a tumour and cysts a liver and a pancreas).
4. Diagnostic opportunities of MRI at research of gastrointestinal tract and accessory digestive organs.

### PRACTICAL SKILLS

1. To estimate the morphological and functional changes in the most common diseases of the liver and pancreas with radiologist consultation or according to the protocol of radiological research.
2. Recognize focal hepatic lesions (cysts, tumors), cholelithiasis on their sonograms.

### THE LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 15.

## LESSON №16

**LESSON FOCUS: nuclear medicine and radiological imaging for investigation of the endocrine system.**

### LEARNING OUTCOME

*Students should know:*

- beam anatomy and physiology of glands endocrine system;
- methods of beam diagnostics them diseases;
- to be able to define indications and contra-indications to purpose of each method.

### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work - 35 min.
4. Common findings on current subject - 10 min

*Place of undertaking of lesson: educational room, radiological departments.*

*Duration: 3academic hours*

### REQUIRED THEORETICAL KNOWLEDGE

1. Beam anatomy and physiology of glands of endocrine system (thyroid and parathyroid glands, adrenal glands).
2. Ultrasonic research of adrenal glands, thyroid and parathyroid glands. Opportunities, indications and contra-indications.
3. Methods of nuclear medicine researches of adrenal glands, thyroid and parathyroid glands. Preparation, opportunities, indications and contra-indications.
4. Radiological diagnostic patterns of diseases of adrenal glands, thyroid and parathyroid glands (adenoma of thyroid gland, endemic goiter, tumours, cysts, , thyroiditis, thyrotoxicosis).

### PRACTICAL SKILLS

1. On the basis of the anamnesis and a clinical picture of illness to define indications and contra-indications to beam inspection.
2. To perform direction to the radiologist and to carry out preparation of the patient for beam research in endocrinology.
3. Together with radiologist to plan volume and sequence of beam researches at diseases in endocrinology (X-ray, ultrasonic, radionuclide, MRI).

### THE LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 16.

## LESSON №17

### LESSON FOCUS: radiological researches in urology and nephrology

#### LEARNING OUTCOME

##### Students should know:

- radiological anatomy of kidneys and urinary tract;
- the x-ray methods for diagnostic diseases of urinary tract;
- to define indications and contra-indications to each method;
- to be able to choose optimum methods of research at various pathology of kidneys and urinary tract.

#### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work - 35 min.
4. Common findings on current subject - 10 min

*Place of undertaking of lesson: educational room, radiological departments.*

*Duration: 3 academic hours*

#### REQUIRED THEORETICAL KNOWLEDGE

1. Methods of radiological researches of kidneys and urinary tract (ultrasound investigations, intravenous urography, retrograde pyelography, CT, angiography). Opportunities, indications and contra-indications.
2. Radiologic semiotics of diseases of kidneys and urinary tract (a sharp and chronic pyelonephritis, glomerulonephritis, stones, nephroptosis, dystopic kidneys, hydronephrosis, tumours).
- 3.

#### PRACTICAL SKILLS

1. On the basis of the anamnesis and a clinical picture of illness to define indications and contra-indications to radiologic inspection.
2. To carry out preparation of the patient for radiologic researches.
3. Together with the radiologist to perform plan volume and sequence of beam researches.
4. At consultation of the radiologist to estimate morphological and functional changes at the most often frequent diseases of kidneys and urinary tract (a sharp and chronic pyelonephritis, glomerulonephritis, stones, nephroptosis, dystopic kidneys, hydronephrosis, tumours).

#### THE LITERATURE AND OTHER SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 17.

## LESSON №18

### LESSON FOCUS: nuclear medicine and radiological imaging for investigation of the nervous system

#### LEARNING OUTCOME

##### *Students should know:*

- beam anatomy and physiology of a hypophysis, head and a spinal cord;
- methods of the beam diagnostics, used at their diseases;
- indications and contra-indications at their assignment;
- to be able to choose optimum techniques of research.

#### SCHEDULE PLAN OF LESSON

1. Check of level theoretical knowledge of students - 35 min.
2. Independent work of students with material for learning -55 min.
3. Discussion of results of independent work - 35 min.
4. Common findings on current subject - 10 min

*Place of undertaking of lesson: educational room, radiological departments.*

*Duration: 3 academic hours*

#### REQUIRED THEORETICAL KNOWLEDGE

1. Methods of radiological examination and normal appearance of skull, backbone, brain and the spinal cord. Opportunities. Indications and contra-indications.
2. Radiological pattern in injuries and diseases of the skull and the brain: traumatic injuries, cerebral circulatory disorders, tumors, inflammatory and degenerative diseases.
3. Radiological pattern in traumatic injuries, tumors, inflammatory and degenerative diseases of the spine and spinal cord, abnormal development of the brain.

#### PRACTICAL SKILL

To estimate the morphological and functional changes at most frequent diseases of the nervous system with radiologist consultation or according to the protocol of radiological research.

#### THE LITERATURE AND OTHER EDUCATIONAL SOURCES

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.
4. Computer presentation № 18.



## **LESSON №19**

### **The differentiated test (6 semester)**

#### **LEARNING OUTCOME**

Revealing and rating of a level of preparation of the students under the theory of the radiology; definition of a degree of their practical preparation.

#### **SCHEDULE PLAN OF LESSON**

1. The test control of theoretical knowledge of students over the list of questions to test employment - 60 min.
2. The control of practical skills of students (an independent rating the student of results of one of radiological methods) - 60 min.
3. Final rating of knowledge of the student the teacher - 15 min.

**Place of studies: classroom.**

**Study duration: 3 hours.**

#### **REQUIRED THEORETICAL KNOWLEDGE**

1. Knowledge of principles of visualization of researched organs with the help of various types of physical radiations.
2. Knowledge of the basic symptoms and syndromes in radiological diagnostic and skill of them to diagnose with the help of clinical images.

#### **LIST OF PRACTICAL SKILLS**

##### **Students must be able to:**

1. Choose radiation therapy and make up a plan of treatment under supervision of the doctor.
2. Recognize independently the image of all human organs on radiograph, to indicate their major anatomical structures.
3. Identify shadows and radiolucency on radiographs.
4. Define hyperdensity and hypodensity zones on computer tomography.
5. Identify the image of organs on sonograms.
6. Identify areas of hyper- and hypoechoic.
7. Recognize independently the organs on the magnetic resonance image.
8. Recognize independently the organs on the scintigram.
9. Write their own direction for the diagnostic imaging, with the particular disease.
10. Make a protocol of radiological image injuries and diseases of the musculoskeletal system.
11. Identify independently the X-ray abnormalities in the lungs and make it into a research protocol.

12. Estimate independently the x-ray image and perform x-ray protocol for acute lung diseases, such as pneumothorax, pneumonia, hydrothorax.
13. Check out the direction to the radiologist and make preparation of the patient to X-ray examination.
14. According to X-ray image to define the basic parameters of the anatomical images of the heart and great vessels.
15. Determine basics pathological heart forms and vascular lesions by X-ray data.
16. To estimate the morphological and functional changes in the most common diseases of the heart with radiologist consultation or according to the protocol of radiological research.
17. Recognize x-ray signs of perforated ulcer, acute intestinal obstruction.
18. Identify basics radiograph syndromes with diseases of gastro-intestinal tract
19. To estimate the morphological and functional changes in the most common diseases of the liver and pancreas with radiologist consultation or according to the protocol of radiological research.
20. Recognize focal hepatic lesions (cysts, tumors), cholelithiasis on their sonograms.
21. To estimate the morphological and functional changes in the most common renal diseases on radiological images with radiologist consultation or according to the protocol of radiological research.
22. Identify the scope and sequence of radiological researches in diseases of the endocrine system.
23. To estimate the morphological and functional changes at most frequent diseases of the nervous system with radiologist consultation or according to the protocol of radiological research.

## **THE LITERATURE AND OTHER EDUCATIONALSOURCES**

1. Овчинников, В.А. Radiology and radiation oncology: Textbook for the third year students of medical university (in English) / В.А. Овчинников. – Гродно: ГрГМУ, 2014. – 352.
2. Daffner, Richard H. Clinical Radiology [Текст] : the Essentials / Richard H. Daffner, Matthew S. Hartman, 2014. - XIII, 546 p.
3. Lecture material.

**QUESTIONS TO THE DIFFERENTIATED TEST ON RADIOLOGY  
for the third-year international students (6 semestr)  
in specialty “General Medicine”  
(English medium)**

1. X-ray, nuclear medicine, ultrasonic, magnetic resonance methods at research of musculoskeletal system.
2. The order of the analysis of x-ray film of musculoskeletal system. Age features.
3. The basic x-rays symptoms at damages of bones and joints.
4. The basic radiological signs of diseases of bones and joints.
5. Radiological researches at inflammatory diseases of bones and joints.
6. Radiological researches at malignant tumours of a skeleton and soft tissues.
7. X-ray data of a deforming arthrosis.
8. X-ray data of an osteochondrosis of a backbone.
9. Methods of a X-ray inspection of lung. A diagnostic minimum.
10. Technique of the analysis of x-ray film of a thorax.
11. Technique of the analysis of shadows on x-ray film of thorax.
12. Indications to x-ray filming, fluoroscopy of lungs.
13. Indications to a computerized tomography of lungs and mediastinum.
14. The basic radiological syndromes at diseases and damages of lung.
15. Differential radiological diagnostics the total or subtotal shadow of pulmonary fields.
16. Differential radiological diagnostics at a round shadow in a pulmonary field.
17. Differential radiological diagnostics at a ring shadow in a pulmonary field.
18. X-ray data of an acute pneumonia (lobar a pneumonia, bronchopneumonia, streptococcal and staphylococcal pneumonia).
19. X-ray data of a chronic bronchitis..
20. X-ray data of an primary pulmonary tuberculosis and tuberculosis of intrachest lymph nodes
21. X-ray data of hematogenously disseminated tuberculosis of lung.
22. X-ray data a focal tuberculosis of lung.
23. X-ray data of infiltration-pneumonic tuberculosis of lung and tuberculoma.
24. X-ray data of a pleurisy.
25. X-ray data of cavernous and fibrosis- cavernous tuberculosis of lung.
26. Radiological attributes of a central lung cancer.
27. Radiological attributes of a peripheric lung cancer.
28. Role of radionuclid researches of organs of breath at diagnostics of lung diseases (an inhalation and perfused scintigraphy, a positive scintigraphy).
29. Methods of a X-ray inspection of heart and blood vessels (x-ray film, a computerized tomography, an angiocardiology, an arteriography).

30. Methods of visualization of lymph nodes.
31. Methods of ultrasound research of heart and vessels and their diagnostic opportunities.
32. Indications to application, clinical value radionuclide (nuclear medicine) researches of cardiovascular system (nuclear myocardial perfusion imaging).
33. Methods of X-ray investigation of gastrointestinal tract (fluoroscopy, x-ray films, computerized tomography).
34. Methods of ultrasonic researches of a liver and pancreas, ultrasonic anatomy, diagnostic opportunities.
35. Radiological attributes of pathological processes in a liver: a trauma, a cyst, a tumour.
36. Radiological attributes of pathological processes in a liver: a hepatitis acute and chronic, a cirrhosis of a liver.
37. Radiological attributes of obstruction of bile ducts.
38. Radiological attributes of an acute cholecystitis, cholelithiasis.
39. Radiological attributes of an acute and chronic pancreatitis, cancer of a pancreas.
40. Methods of nuclear medicine researches for a liver. A principle, clinical value.
41. Radiological indications of a perforated stomach ulcer and acute coliform obstruction (X-ray inspections at acute belly catastrophes).
42. Radiological attributes of a stomach and duodenum ulcer.
43. Radiological attributes of a malignant and benign tumours of a gastrointestinal tract.
44. Kinds of radionuclide researches of kidneys (radiorenography, dynamic nephroscintigraphy, angyonephroscintigraphy).
45. Ultrasonic researches of urinary tract (a principle, opportunities, indications, contraindications).
46. Methods radiological diagnostics of urinary tract (survey X-ray film, intravenous urography, retrograde ureteropyelography, cystography, computerized tomography).
47. Radiological attributes of a pyelonephritis, glomerulonephritis, urolithiasis.
48. Radiological attributes renal cysts, renal cells carcinoma.
49. Radiological attributes of renal trauma.
50. Ultrasonic research of adrenal glands, thyroid and parathyroid glands. Opportunities, indications and contra-indications.
51. Methods of nuclear medicine researches of thyroid gland. Preparation, opportunities, indications and contra-indications.
52. Radiological signs of diseases of thyroid glands (adenoma of thyroid, endemic goiter, tumours, cysts, thyroiditis, thyrotoxicosis).