

**MINISTRY OF HEALTH PROTECTION OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY**

Medical Faculty №2

Department of radiation diagnostics, therapy and radiation medicine and oncology

I APPROVE

Vice-rector for scientific and pedagogical work

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September 1, 2023

**METHODOLOGICAL DEVELOPMENT
TO PRACTICAL LESSONS
FROM EDUCATIONAL DISCIPLINE**

Faculty, MEDICAL course, 2nd year

Educational discipline RADIOLOGY

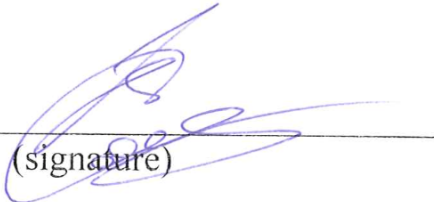
Odesa-2023

Approved:

Meeting of the Department of the Radiation Diagnostics, Therapy and Radiation
Medicine and Oncology
Odessa National Medical University

Protocol No. 1 dated 30.08. 2023

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PRACTICAL TRAINING

Content module 5.

Complex radiation diagnosis of diseases of the musculoskeletal system

Practical lesson No. 13.

Topic 13. Radiological research methods and radiological anatomy of the musculoskeletal system.

Goal: to learn how to choose a certain method of radiographic examination and analyze indications and contraindications for carrying out this or that radiographic method of research of the musculoskeletal system; explain the advantages and disadvantages of each of the radiation research methods and their characteristics; learn how to analyze radiographic images of the musculoskeletal system in normal and pathological conditions

Basic concepts: Radiation research methods: X-ray, radionuclide methods, ultrasound, CT, MRI. X-ray methods of bone and joint research: X-ray, tomography, fistulography, pneumoarthrography, angiography, densitometry. Normal radiological anatomy of bones and joints: structure in the X-ray image, age-related features of the structure. Procedure for studying and describing the results of X-ray examination of bones and joints. Radiographic signs of functional and morphological changes in the pathology of bones and joints. Changes in shape, size, position of bones, inconsistency of joint ends; changes in contours (periostitis, periostosis), changes in structure (osteoporosis, osteosclerosis, destruction, osteonecrosis, osteolysis, atrophy), changes in the joint space (narrowing, disappearance, compaction of joint surfaces, marginal bone growths).

Equipment: laptop with presentation, multimedia projector, radiographs, tomograms

Plan:

1. Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of students of higher education to study the topic).

2. Control of the reference level of knowledge:

2.1 Requirements for theoretical readiness of students to perform practical classes:

Know:

1. the principles of obtaining a radiographic image and being able to determine by which method of radiographic examination an ORS image was obtained
2. the topographical anatomy of the ORS of a person in accordance with the specifics of the introduced methods of radiological diagnostics
3. anatomic and functional features of the X-ray image of ORS in normal and pathological conditions in the age aspect
4. morphological and functional indicators of ORS

2.2. Questions to check basic knowledge on the topic of the lesson:

1. List the methods of radiation examination of the skeleton
2. List the main elements of the x-ray anatomy of the tubular bone
3. List the features of radiographs of bones in children
4. Determine the indications for the use of CT
5. Determine the indications for the use of MRI
6. Determine the indications for the use of osteoscintigraphy
7. Determine the indications for using densitometry

1. The greatest thickness of the cortical layer is observed in:

- A. diaphysis
- B. metaphysics
- B. epiphysis
- V. apophysis

2. The articular part of the long tubular bone is called:

- A. epiphysis
- B. metaphysic
- B. diaphysis
- G. apophysis

3. Formation of professional abilities and skills (mastery of communication skills, dispensation, determination of treatment scheme, laboratory research, etc.) to be able to:

1. on the basis of anamnesis, choose the method of X-ray examination of ORS
2. to analyze the necessity of carrying out radiation methods of ORS research
3. justify indications and contraindications to the beam method
4. to be able to use the knowledge of radiological anatomy of ORS and methods of radiological research in practice

1. Indications for the use of MRI in pathology of the bone and joint system:

- A. indication of a focus of purulent inflammation
- B. assessment of the rate of bone callus formation
- B. assessment of the spread of the tumor to the bone marrow and surrounding soft tissues

2. The use of osteoscintigraphy in the examination of the skeleton is based on:

- A. state of bone blood flow and bone metabolism
- B. high resolution in visualization of the bone structure
- B. assessment of the state of the bone marrow
- D. evaluation of the condition of the periosteum

3. What process is characterized by an increase in bone density, which is manifested in the form of thickening of bone trabeculae and compact bone substance on an X-ray:

- A. osteosclerosis
- B. periostitis
- B. osteoporosis
- G. bone atrophy

4. Which of the radiological research methods is the most reliable in the diagnosis of osteoporosis?

- A. densitometry
- B. CT
- B. radiography
- G. MRI

Recommendations (instructions) for the performance of tasks (professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

Algorithm of radiographic research of the locomotor system

Type of pathology	Primary research methods	Additional research methods
Bone disease	Radiography Osteoscintigraphy	CT , Linear tomography , Densitometry , MRI
Arthropathy	Osteoscintigraphy , ultrasound	Arthrography

	Radiography	CT arthrography SCT-arthrography MRI MR arthrography
Diseases of soft tissues	ultrasound	MRI CT Radiography

Requirements for work results, including registration:

At the beginning of the description of any diagnostic method, it is necessary to indicate the following data:

1. P.I.B. and age of the patient
2. The date of the examination
3. The name of the method and/or methodology, if necessary, the conditions of implementation
4. Specify the studied area and projections.

Control materials for the final stage of the lesson (tasks, assignments, tests, etc.)

1. Methods of X-ray research, which are used to diagnose pathological bone processes:
 - A. radiography
 - B. computed tomography
 - B. osteoscintigraphy
 - G. ultrasound examination
 - D. all the listed methods
 - E. the correct answers are B and C
2. What is the main research method in osteology?
 - A. fluorography
 - B. linear tomography
 - B. radiography
 - D. x-ray with direct magnification of the image
 - D. computer tomography
3. X-ray joint gap is the space between:
 - A. closing plates of articular parts of bones
 - B. articular cartilages
 - V. germinal cartilage

Patient U., 55 years old. Complaints of pain in the thoracic spine. . Name the research method.



Patient U., 10 years old. Complaints of pain in the lower third of the thigh for 6 days, fever. There was no injury. Independent treatment. Referral to a family doctor. Consultation of a traumatologist. Name the method and area of research.



Practical lesson No. 14.

Topic 14. Radiation signs of traumatic injuries of the upper and lower extremities, damage to the skull, spine, pelvic bones.

Goal: to learn how to choose a certain method of radiographic research and analyze indications and contraindications for carrying out this or that radiographic method of research of the musculoskeletal system; explain the advantages and disadvantages of each of the radiation research methods and their characteristics; learn how to analyze radiographic images of the musculoskeletal system in normal and pathological conditions

Basic concepts: X-ray signs of traumatic damage to bones and joints - fractures, dislocations. Types of debris displacement. Peculiarities of fractures in children and the elderly. X-ray picture of normal fracture healing. Complication of fracture healing. Radiological signs of traumatic damage to the skull, spine, pelvic bones - fractures, dislocations. Types of debris displacement. Peculiarities of fractures in children and the elderly. Complication of fracture healing. Algorithm of research in case of trauma to the skull, spine, pelvic bones.

Equipment: laptop with presentation, multimedia projector, radiographs, tomograms

Plan:

1. Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of students of higher education to study the topic).

2. Control of the reference level of knowledge:

2.1 Requirements for theoretical readiness of students to perform practical classes:

Know:

5. the principles of obtaining a radiographic image and being able to determine by which method of radiographic examination an ORS image was obtained
6. the topographical anatomy of the ORS of a person in accordance with the specifics of the introduced methods of radiological diagnostics
7. anatomic and functional features of the X-ray image of ORS in normal and pathological conditions in the age aspect
8. morphological and functional indicators of ORS

2.2. Questions to check basic knowledge on the topic of the lesson:

1. The transition from the cartilaginous skeleton to the bony skeleton is completed by:
 - A. 25 years old
 - B. 15 years old
 - B. 20 years old
 - G. 10 years old
2. An oblique fracture is:
 - A. fracture line with displacement of bone fragments along the axis
 - B. fracture line with angular displacement of fragments
 - B. deformation of the external contour of the bone by the type of bracket or step
3. Traumatic epiphysiolysis:
 - A. osteolysis of the epiphysis due to trauma
 - B. displacement of the epiphysis along the growth zone
 - B. absence of pineal gland

3. Formation of professional abilities and skills (mastery of communication skills, dispensation, determination of treatment scheme, laboratory research, etc.) to be able to:

1. evaluate radiation semiotics when identifying signs of traumatic injury;
 2. to distinguish a normal X-ray image of bones and joints from a pathological one in case of injury;
 3. recognize direct and indirect signs of ORS injuries, features of traumatic injuries in childhood
1. One of the direct X-ray signs of a fracture is
 - A. displacement of bone fragments
 - B. bone deformation
 - B. bone destruction
 2. Features of bone fractures in children include:
 - A. comminuted fractures
 - B. pronounced bone deformation
 - B. epiphysiolysis
 - D. slight displacement of fragments.
 3. Transverse subperiosteal fracture of a long tubular bone usually occurs in:
 - A. elders
 - B. persons of mature age
 - V. children
 - G. elderly people

1. Patient Z., 43 years old, suffered a back injury. He complains of sharp pain in the region of Th11-12 vertebrae. X-ray examination - dubious data were obtained about the fracture of the transverse processes and brackets of the above-mentioned vertebrae.

What method of radiation research will help to solve these doubts?

Answer: CT scan of the thoracolumbar section.

2. A 25-year-old athlete, having landed unsuccessfully, felt a sharp pain in the area of the left hip joint. During the examination, sores and swelling are determined. Radiography did not reveal any pathology. Damage to the soft tissue structures of the joint is suspected. What method of radiological examination will allow to visualize the above changes?

Answer: MR tomography of the hip joints.

Recommendations (instructions) for the performance of tasks (professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

To determine the leading X-ray syndrome, the following actions must be performed sequentially:

- distinguish the norm from pathology;
- determine radiological symptoms of pathology;
- determine radiological signs of the syndrome.

Orientation map for the formation of practical skills and abilities

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Evaluate bone size	Based on the comparison of paired bones or adjacent vertebrae	The number of pathological changes of this indicator includes hypotrophy, hypertrophy, hyperostosis and swelling of the bone
2.	Evaluate bone contours	Equality, continuity, smooth arched transition of one part of the bone to another	X-ray signs of pathological changes in bone contours are discontinuity, straightness, unevenness, and the absence of closing plates that limit the metaphyses and epiphyses of tubular bones
3.	Evaluate the state of the bone structure	Clear differentiation into the cortical layer and bone marrow canal, uniform optical density of the cortical layer, homogeneity of the structure of the bone marrow canal.	The uniform porous nature and the presence of the so-called "force lines" characteristic of each of them (groups of thickened, closely spaced bone plates, equally oriented along the main directions of stretching and compression
4.	Assess the anatomical relationships in the joints	X-ray joint height	The main indicator of the correctness of the anatomical proportions is the uniform height of the X-ray joint gap

Requirements for work results, including registration:

At the beginning of the description of any diagnostic method, it is necessary to indicate the following data:

1. P.I.B. and age of the patient
2. The date of the examination
3. The name of the method and/or methodology, if necessary, the conditions of implementation
4. Specify the studied area and projections.

Schematic description of the radiograph of bones and joints:

1. methodology and area of research
2. projections of the research area
3. position, size and shape of bones
4. contours of the crustal layer, its thickness
5. bone structure

6. periosteal reaction
7. the state of the bone marrow canal
8. ossification nuclei and growth zones in children
9. ratio of articular surfaces
10. shape and size of joint spaces and condition of soft tissues
11. clinical and radiological conclusion

Control materials for the final stage of the lesson (tasks, assignments, tests, etc.)

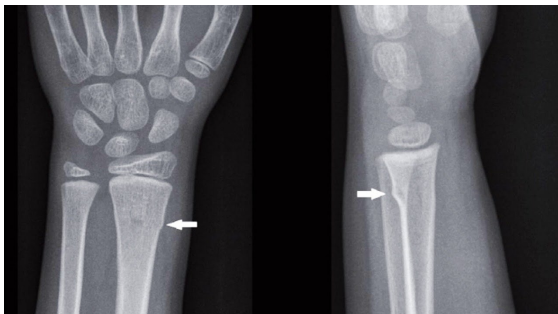
Task 1.



Task 2.



Task 3.



Practical lesson No. 15.

Topic 15. Radiation signs of inflammatory diseases of the musculoskeletal system.

Goal: to learn how to choose a certain method of radiographic research and analyze indications and contraindications for carrying out this or that radiographic method of research of the musculoskeletal system; explain the advantages and disadvantages of each of the radiation research methods and their characteristics; learn how to analyze radiographic images of the musculoskeletal system in normal and pathological conditions

Basic concepts: Radiological signs of inflammatory lesions of the musculoskeletal system: arthritis, osteomyelitis (acute and chronic), tuberculosis of bones and joints.

Equipment: laptop with presentation, multimedia projector, radiographs, tomograms

Plan:

1. Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of students of higher education to study the topic).

2. Control of the reference level of knowledge:

2.1 Requirements for theoretical readiness of students to perform practical classes:

Know:

1. the principles of obtaining a radiographic image and being able to determine by which method of radiographic examination an ORS image was obtained
2. the topographical anatomy of the ORS of a person in accordance with the specifics of the introduced methods of radiological diagnostics
3. anatomic and functional features of the X-ray image of ORS in normal and pathological conditions in the age aspect
4. morphological and functional indicators of ORS

2.2. Questions to check basic knowledge on the topic of the lesson:

Typical X-ray signs of acute hematogenous osteomyelitis on the 10-14th day of the disease are:

- and. all answers are correct
- b. the focus of destruction in the metaphysis
- in. reactive sclerosis
- d. spotting and inhomogeneity of the bone structure
- d. linear periostitis

3. Formation of professional abilities and skills (mastery of communication skills, dispensation, determination of treatment scheme, laboratory research, etc.) to be able to:

1. choose the optimal method of X-ray examination of ORS;
2. to evaluate radiation semiotics when identifying signs of inflammatory lesions of ORS;
3. to distinguish a normal x-ray image of bones and joints from a pathological one with inflammatory lesions;
4. recognize direct and indirect signs of inflammatory lesions of ORS

1. X-ray signs of bone and periosteum in acute hematogenous osteomyelitis in most cases are revealed due to:

- and. 7-10 days
- b. 1-1.5 months
- in. 3-4 weeks

- g. 2 months
2. The articular part of the long tubular bone is called:
 and. pineal gland
 b. apophysis
 in. diaphysis

Recommendations (instructions) for the performance of tasks (professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

To determine the leading X-ray syndrome, the following actions must be performed sequentially:

- distinguish the norm from pathology;
- determine radiological symptoms of pathology;
- determine radiological signs of the syndrome.

Orientation map for the formation of practical skills and abilities

No	Main tasks	Instructions	Answers
1	2	3	4
1.	Evaluate bone size	Based on the comparison of paired bones or adjacent vertebrae	The number of pathological changes of this indicator includes hypotrophy, hypertrophy, hyperostosis and swelling of the bone
2.	Evaluate bone contours	Equality, continuity, smooth arched transition of one part of the bone to another	X-ray signs of pathological changes in bone contours are discontinuity, straightness, unevenness, and the absence of closing plates that limit the metaphyses and epiphyses of tubular bones
3.	Evaluate the state of the bone structure	Clear differentiation into the cortical layer and bone marrow canal, uniform optical density of the cortical layer, homogeneity of the structure of the bone marrow canal.	The uniform porous nature and the presence of the so-called "force lines" characteristic of each of them (groups of thickened, closely spaced bone plates, equally oriented along the main directions of stretching and compression
4.	Assess the anatomical relationships in the joints	X-ray joint height	The main indicator of the correctness of the anatomical proportions is the uniform height of the X-ray joint gap

Requirements for work results, including registration:

At the beginning of the description of any diagnostic method, it is necessary to indicate the following data:

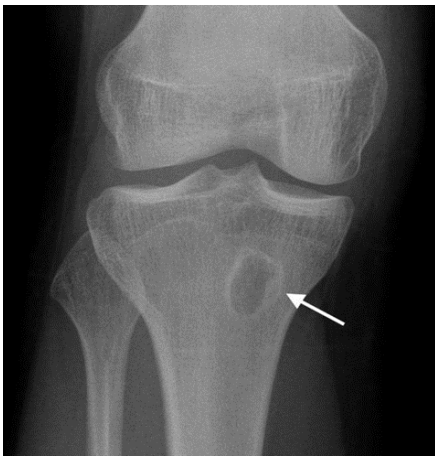
1. P.I.B. and age of the patient
2. The date of the examination
3. The name of the method and/or methodology, if necessary, the conditions of implementation
4. Specify the studied area and projections.

Schematic description of the radiograph of bones and joints:

1. methodology and area of research
2. projections of the research area
3. position, size and shape of bones
4. contours of the crustal layer, its thickness
5. bone structure
6. periosteal reaction
7. the state of the bone marrow canal
8. ossification nuclei and growth zones in children
9. ratio of articular surfaces
10. shape and size of joint spaces and condition of soft tissues
11. clinical and radiological conclusion

Control materials for the final stage of the lesson (tasks, assignments, tests, etc.)

Patient U., 30 years old. For a long time, complaints of aching pain in the right knee joint, sometimes the skin in the joint area becomes warmer to the touch. Describe the radiograph.



Patient U., 55 years old. Complaints of pain in the thoracic spine. . Name the research method. List the radiological symptoms (1, 2, 3, 4). Your previous diagnosis:



Patient U., 10 years old. Complaints of pain in the lower third of the thigh for 6 days, fever. There was no injury. Independent treatment. Referral to a family doctor. Consultation of a traumatologist.

Name the method and area of research. Name of the picture. Identified symptoms (1, 2). Your previous diagnosis:



Boy, 11 years old. Complaints of pain and swelling of the second finger. Sprained my finger two weeks ago . Name the X-ray symptom. Your previous diagnosis:



Practical lesson No. 16.

Topic 16. Radiological signs of tumors of the musculoskeletal system.

Goal: to learn how to choose a certain method of radiographic examination and analyze indications and contraindications for carrying out this or that radiographic method of research of the musculoskeletal system; explain the advantages and disadvantages of each of the radiation research methods and their characteristics; learn how to analyze radiographic images of the musculoskeletal system in normal and pathological conditions

Basic concepts: Radiographic signs of bone tumors: benign (chondromas, osteomas, osteochondromas), malignant (osteogenic sarcoma, Ewing's sarcoma, osteoblastoclastoma, metastases). Radionuclide semiotics of tumor lesions of bones and joints (primary and secondary).

Equipment: laptop with presentation, multimedia projector, radiographs, tomograms

Plan:

1. Organizational measures (greetings, verification of those present, announcement of the topic, purpose of the lesson, motivation of students of higher education to study the topic).

2. Control of the reference level of knowledge:

2.1 Requirements for theoretical readiness of students to perform practical classes:

Know:

5. the principles of obtaining a radiographic image and being able to determine by which method of radiographic examination an ORS image was obtained

6. the topographical anatomy of the ORS of a person in accordance with the specifics of the introduced methods of radiological diagnostics
7. anatomic and functional features of the X-ray image of ORS in normal and pathological conditions in the age aspect
8. morphological and functional indicators of ORS

2.2. Questions to check basic knowledge on the topic of the lesson:

What X-ray signs are characteristic of benign bone tumors:

- and. the contours of the formation and the rim of sclerosis are clear
- b. periosteal reaction
- in. rapid development of neoplasm
- g. pain sensations

Chondroma is:

- and. a benign tumor that is formed from cartilage tissue
- b. a benign tumor that is formed from bone tissue
- in. a malignant tumor that is formed from cartilage tissue
- d. a malignant tumor that is formed from bone tissue

Computed tomography in Ewing's sarcoma allows:

- and. all of the above
- b. detect small "hot spots" that cannot be seen on x-rays
- in. determine the size of the tumor
- d. to detect distant metastases

Most often, among primary bone tumors, the following are diagnosed:

- and. all of the above
- and. Ewing's sarcoma
- b. chondrosarcoma
- in. osteosarcoma

3. Formation of professional abilities and skills (mastery of communication skills, dispensation, determination of treatment scheme, laboratory research, etc.) to be able to:

1. choose the optimal method of X-ray examination of ORS;
2. to evaluate the radiation semiotics when identifying signs of a tumor lesion of ORS;
3. to distinguish a normal x-ray image of bones and joints from a pathological one with tumor lesions;
4. recognize direct and indirect signs of ORS tumors

Recommendations (instructions) for the performance of tasks (professional algorithms, orientation maps for the formation of practical skills and abilities, etc.)

To determine the leading X-ray syndrome, the following actions must be performed sequentially:

- distinguish the norm from pathology;
- determine radiological symptoms of pathology;
- determine radiological signs of the syndrome.

Orientation map for the formation of practical skills and abilities

No	Main tasks	Instructions	Answers
1	2	3	4

1.	Evaluate bone size	Based on the comparison of paired bones or adjacent vertebrae	Pathological changes of this indicator include hypotrophy, hypertrophy, hyperostosis, and bone swelling
2.	Evaluate bone contours	Equality, continuity, smooth arched transition of one part of the bone to another	X-ray signs of pathological changes in bone contours are discontinuity, straightness, unevenness, and the absence of closing plates that limit the metaphyses and epiphyses of tubular bones
3.	Evaluate the state of the bone structure	Clear differentiation into the cortical layer and bone marrow canal, uniform optical density of the cortical layer, homogeneity of the structure of the bone marrow canal.	The uniform porous nature and the presence of the so-called "force lines" characteristic of each of them (groups of thickened, closely spaced bone plates, equally oriented along the main directions of stretching and compression

Requirements for work results, including registration:

At the beginning of the description of any diagnostic method, it is necessary to indicate the following data:

1. P.I.B. and age of the patient
2. The date of the examination
3. The name of the method and/or methodology, if necessary, the conditions of implementation
4. Specify the studied area and projections.

Schematic description of the radiograph of bones and joints:

1. methodology and area of research
2. projections of the research area
3. position, size and shape of bones
4. contours of the crustal layer, its thickness
5. bone structure
6. periosteal reaction
7. the state of the bone marrow canal
8. ossification nuclei and growth zones in children
9. ratio of articular surfaces
10. shape and size of joint spaces and condition of soft tissues
11. clinical and radiological conclusion

Control materials for the final stage of the lesson (tasks, assignments, tests, etc.)

Task 1



Task 2



4. Summary:

Current evaluation criteria in practical training

Rating	Evaluation criteria
Perfectly "5"	The applicant takes an active part in practical training; demonstrates deep knowledge, gives complete and detailed answers to questions; takes an active part in the discussion of the results of the radiological examination, correctly and consistently compiles the algorithm of the radiological examination in relation to a certain pathology; uses additional educational and methodological and scientific literature; expresses his own reasoning, gives appropriate examples, demonstrates clinical thinking. The test tasks are completed in full, all 100% of the answers to the questions are correct.
Fine "4"	The applicant participates in a practical session; knows the material well; demonstrates the necessary knowledge, but gives answers to questions with some errors; participates in the discussion of the results of radiation research, uses basic educational and methodological and scientific literature. The winner expresses his opinion on the subject of the lesson, demonstrates clinical thinking. The test tasks are completed in full, at least 70% of the answers to the questions are correct.
Satisfactorily "3"	The acquirer sometimes participates in a practical activity; partially speaks and asks questions; makes mistakes when answering questions; shows passive work in practical classes; the radiological research algorithm for a certain pathology is inconsistent with significant errors; shows fragmentary knowledge of the conceptual apparatus and literary sources. The acquirer does not express his opinion on the topic for any reason . The testing is done in full, at least 50% of the answers are correct.
Unsatisfactori	The acquirer does not participate in the practical session, is only an observer; never

ly "2"	speaks or asks questions, disinterested in learning the material; does not take part in the discussion of the results of radiological examination, incorrectly compiles the algorithm of radiological examination for a certain pathology, gives incorrect answers to questions, shows unsatisfactory knowledge of the conceptual apparatus and literary sources. Testing is done, but less than 50% of the answers are correct.
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5. List of recommended literature

Main:

1. Kovalsky O.V. Radiology. Radiation therapy. X-ray diagnostics: assistant. for students higher honey. education closing IV level of accreditation / O. V. Kovalskyi, D. S. Mechev, V. P. Danylevich. 2nd edition Vinnytsia: New Book, 2017. 512 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. Methods of radiation diagnostics: a study guide (Protocol of the Medical Center No. 5 dated 05.25.17) N.V. Tumanska, K.S. Barska. 143 p.

Additional:

6. Radiation medicine: Textbook for medical universities 3-4 academic year. approved by the Ministry of Education and Culture / edited by E. Pylypenka Kyiv, 2018. 232 p. kind. "Medicine".
7. Tomographic methods of radiodiagnostics: a study guide (Protocol of the Central Medical Center No. 5 dated 05.25.17) N.V. Tumanska, K.S. Barska, I.P.Jos, 91 p.
8. Diagnostic, treatment and preventive algorithms in internal medicine: teaching method. manual / under the editorship Prof. V. I. Denesyuk; Vinnytsia national honey. University named after M. I. Pirogov, Cafe. internal Medicine No. 3. Kyiv: DZK Center, 2015. 151 p. : fig., tab.
9. Clinical Radiology : The Essentials Fourth Edition by Daffner MDFACR, Dr. Richard H., Hartman MD, Dr. Ma 4th edition. 2014. 546 p.

Electronic information resources:

1. <https://radiographia.info/>
2. <http://nld.by/help.htm>
3. <http://learningradiology.com>
4. <http://www.radiologyeducation.com/>
5. <http://www.radiologyeducation.com/>
<https://www.sonosite.com>