



Non-Commercial Educational Institution
Educational-Scientific-Production Complex
«International University of Kyrgyzstan»

Quality Management System
Academic and methodological complex of the discipline
«Nephrology»
MEP of «General Medicine» ISM IUK

INTERNATIONAL UNIVERSITY OF KYRGYZSTAN
INTERNATIONAL SCHOOL OF MEDICINE
Department of Therapy



Syllabus

OF THE DISCIPLINE «RADIAL THERAPY»

Main educational program

specialty of **560001 General Medicine (for foreign citizens)**
(code, direction name / specialty)

qualification of the graduate: general practitioner

(the qualification of the graduate is indicated in accordance with SES HPE)

Full-time education

Courses 2,3,4

Semesters 3,4,5,8

Credit + / Exam

Total curriculum credits 3

Work program developer: assistant Zhyrgalbekova Ch. K.

Head of the Department: Prof. Baitova G. M.

Bishkek 2021



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1. The work program of the academic discipline

1.1.Explanatory note

- **Mission of the ISM IUK** – *training of competent specialists in the field of medicine, consistent with international standards and traditions of medical ethics, ready for continuous professional growth using modern achievements of science and practice, to solve public health problems.*

Annotation of the academic discipline

The AMC for the "Radial therapy" discipline is compiled in accordance with the Regulations on the Academic and Methodological Complex of the discipline, approved by the Protocol of the Academic Council No. 6 of October 20, 2020, by the Addendum to the Regulations on the modular grade-rating system for assessing the knowledge of students in the NCEI ESPC "IUK" (Protocol No. 42 of 07.26.2018, as well as on the basis of the State educational standard of higher professional education in the direction of "Medicine", approved by the Government Decree of 2015. The AMC of the "Nephrology" discipline was developed for second-fourth years students in the direction of "General Medicine" 560001 in compliance with the requirements of the State Educational Standard of Higher Professional Education of the Ministry of Education and Science of the Kyrgyz Republic.

There is not a single condition and disease in which the RT is not "interested". Timely objective identification of the main visual pathological signs/symptoms, instrumental verification of clinic-laboratorial researches of diseases and even adequate radial treatment will not only improve the patient's quality of life but will reduce the rate of progression, chronisation of diseases, oncogenesis and decrease percentage of lethal cases. Studying the discipline of RT will expand the understanding of the pathogenic causes, thus lets to differentiate the variety of manifestations, similarities, the subtleties of choosing therapy for various, currently most frequent lesions and formatted diseases. This knowledge will be useful in any branch of medicine, regardless of the chosen specialization in the future.

The study of the discipline throughout 2-4th years is necessary for the preparation of a general practitioner who knows the basics of clinical research of a patient with subsequent visual symptoms and syndromes, who knows the basics of etiopathogenesis, clinical picture, classification, treatment of the main, most common diseases and their prevention.



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• Goals and objectives of the discipline

The purpose of the training: to work out the basic skills of instrumental visualization /recognizing signs and symptoms, understanding their path morphological & path functional mechanisms of damages and developments, helping to figure tactics of the patient management next steps.

Tasks: to be able to describe studied problems in the clinical field from the understanding elementary physics of electromagnetic spectrum energies/ construction of diagnostic mashines till the basic practical skills of prescription exact types of radial diagnostics method/examination, providing visual verification/identification/differentiation of the most typical diseases' main visual pathological signs and symptoms, means draw up a plan of instrumental examination of the patient, formulate a visual conclusions in accordance with modern protocols, outline a rational program of the disease study/ treatment for the staffs and even adequately choose efficient types of radiation therapy for particular oncological cases.

• Place of discipline in the structure of MEP (prerequisites, postrequisites).

Requirements for the preliminary preparation of the student:

To study this academic discipline RT, you need the following knowledge, skills and abilities formed by previous disciplines:

- Normal Anatomy and Physiology
- Pathological anatomy & Pathophysiology
- Psychology
- Medical physics and Mathematics
- Medical IT
- Biochemistry and nonorganic chemistry
- Latin language



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Subsequently, the knowledge gained in the course of studying the discipline "Radial therapy" will be necessary in the study of disciplines: "Internal medicine", "Pediatrics", "Polyclinic therapy", "Urology", "Surgery", "Cardiosurgery", "Traumatology", "Otorhinolaryngology", "Obstetrics and gynecology", "Public medicine" & "Oncology"

Competencies of students, formed as a result of mastering discipline, the planned results of mastering the discipline.

The study of this academic discipline is aimed at the formation of the following students general cultural (GC), general professional (GPC) and professional (PC) competencies:

	code / content of competency	As a result of studying the academic discipline, students must:
1.	<p>Diagnostic activity: PC-3 - Ability and readiness to form a systematic approach to the analysis of radiation medical information, based on the comprehensive principles of evidence-based medicine. PC-5 - capable of working with medical and technical equipment used in working with patients, owning computer equipment, receiving information from various sources, working with information in global computer networks, using the capabilities of modern information technologies to solve professional problems; PC-6 - is able to apply up-to-date information on the health indicators of the population at the level of health care facilities; PC-8 - is able to carry out preventive measures with the attached population to prevent the occurrence of the most common diseases, carry out general health measures to form a healthy lifestyle, taking into account risk factors, and give</p>	<p>know:</p> <ol style="list-style-type: none"> 1. -schematic diagram of the device of diagnostic equipment: X-ray diagnostic apparatus, radiometric equipment, CT tomograph, MR tomograph, ultrasound devices, endoscopes; 2. -principles of obtaining images for different methods of medical imaging; 3. -criteria for assessing the morphological and functional state of organs using different methods of medical imaging; 4. -diagnostic capabilities and limits of each method of radiation diagnostics. 5. -radiation anatomy and physiology of organs and systems; 6. -terminology used in the X-ray method, CT, MRI, ultrasound, radionuclide and endoscopic studies in the analysis of ray images of organs; 7. -indications and contraindications for carrying out certain methods of radiation research; 8. -preparation of the patient for radiation examination; <p>be able to:</p> <ol style="list-style-type: none"> 1. -determine the indications and contraindications for each method of radiation diagnostics;



<p>recommendations on healthy eating;</p> <p>PC-10 - is capable of carrying out anti-epidemic measures, protecting the population in the centers of especially dangerous infections, when the radiation situation worsens and natural disasters;</p> <p>PC-11 - capable and ready to make a diagnosis based on the results of biochemical and clinical studies, taking into account the course of pathology in organs, systems and the body as a whole;</p> <p>PC-12 - is able to analyze the patterns of functioning of individual organs and systems, use knowledge of anatomical and physiological characteristics, the main methods of clinical and laboratory examination of the adult population and children, for the timely diagnosis of diseases and pathological processes;</p> <p>PK-13 - is able to identify in patients the main pathological symptoms and syndromes of diseases, using knowledge of the basics of biomedical and clinical disciplines, taking into account the course of pathology in organs, systems of the body as a whole, to analyze the patterns of functioning of organs and systems in various diseases and pathological processes, use the algorithm for making a diagnosis (main, concomitant, complications), taking into account the ICD-10, carry out the main diagnostic measures to identify urgent and life-threatening conditions;</p> <p>PC-18 - Ability and willingness to analyze and interpret the</p>	<ol style="list-style-type: none"> 2. -to identify the method and technique of the study based on the materials of radiation studies; 3. to identify the image of all human organs and indicate their basic anatomical structures on radiographs, computer and MRI tomograms, sonograms, scintigrams. 4. -outline the volume and rational sequence of radiation studies in diseases of various organs; 5. -to issue a referral for radiation examination; 6. -identify the image of organs and indicate their main anatomical structures on radiographs, sonograms, computer and magnetic resonance tomograms, scintigrams; 7. -to distinguish the visualized norm from pathology; <p>master:</p> <ol style="list-style-type: none"> 1. -Skills in making a referral for radiation examination 2. -the skill of working with documents of radiation diagnostics, using hardware (negatoscope, fluoroscope, computer) - the basics of the skill of conducting differential diagnostics 3. -registration of the patient's referral to certain methods of radiation diagnostics to the appropriate department of the medical institution
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	<p>results of modern radiation diagnostic technologies, taking into account the physiological characteristics of the human body.</p> <p>PK-31 - Ability and willingness to study scientific and medical information, domestic and foreign experience in the field of radiation research</p>	
2	<p>Medical activities:</p> <p>PC-14 - is able to perform basic therapeutic measures for the most common diseases and conditions in adults and children;</p> <p>PC-15 - is able to prescribe adequate treatment to patients in accordance with the diagnosis;</p> <p>PK-16 - is able to provide the adult population and children with first medical aid in case of emergency and life-threatening conditions, to send patients to hospital in a planned and emergency manner.</p>	<p>know: - -terminology used in the X-ray method, CT, MRI, ultrasound, radionuclide and endoscopic studies in the analysis of radial images of organs;</p> <p>-indications and contraindications for carrying out certain methods of radiation research;</p> <p>-preparation of the patient for radiation examination;</p> <p>-radiation symptoms and syndromes of organ damage;</p> <p>-tactics of radiation examination for various syndromes of organ diseases</p> <p>be able to: - interpret the results of the most common methods of laboratory and clinical symptoms in correlation to instrumental diagnostics, to identify pathological processes in human organs and systems;</p> <p>master: - interpretation patients' results of laboratory, instrumental diagnostic methods in correlation to visual data;</p>
6	<p>Rehabilitation activities:</p> <p>PK-19 - capable and ready to apply rehabilitation measures (medical, social and professional) among adults and children</p>	<p>know: -preparation of the patient for radiation examination;</p> <p>-radiation anatomy and physiology of organs and systems;</p> <p>-radiation symptoms and syndromes of organ damage;</p> <p>-tactics of radiation examination for various syndromes of organ diseases</p> <p>-modern principles and results of radical and palliative treatment of malignant neoplasms</p> <p>physical, biological, technical fundamentals of radiation therapy, the concept of dosimetry and its role in preparation for radiation therapy, radiation therapy methods, planning features and possible radiation reactions, management of patients in the</p>



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		<p>post-radiation therapy period and prevention of radiation reactions;</p> <p>be able to: -to distinguish the visualized norm from pathology;</p> <p>-to formulate indications for conservative and surgical treatment.</p> <p>-draw up a radiation therapy plan, determine indications and contraindications, based on anamnestic data, clinical picture, stage and histological nature of the tumor; choose the method of radiation therapy depending on the location of the tumor and determine the complications;</p> <p>master: -Skills of emergency protection against ionizing radiation</p> <p>-Skills in making a referral for radiation examination</p> <p>-the skill of working with documents of radiation diagnostics, using hardware (negatoscope, fluoroscope, computer) - the basics of the skill of conducting differential diagnostics-registration of the patient's referral to certain methods of radiation diagnostics to the appropriate department of the medical institution</p> <p>-skills of drawing up a treatment plan, drawing up a topometric map, predicting and conducting radiation reactions.</p>
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After mastering this discipline, the student:

Will know:

- types and properties of radiation used in radiation diagnostics;
- methods of protection against ionizing radiation;
- regulation of X-ray and radiodiagnostic procedures;
- schematic diagram of the device of diagnostic equipment: X-ray diagnostic apparatus, radiometric equipment, CT tomograph, MR tomograph, ultrasound devices, endoscopes;
- principles of obtaining images for different methods of medical imaging;
- criteria for assessing the morphological and functional state of organs using different methods of medical imaging;
- terminology used in the X-ray method, CT, MRI, ultrasound, radionuclide and endoscopic studies in the analysis of ray images of organs;
- diagnostic capabilities and limits of each method of radiation diagnostics.
- indications and contraindications for carrying out certain methods of radiation research;
- preparation of the patient for radiation examination;
- radiation anatomy and physiology of organs and systems;
- radiation symptoms and syndromes of organ damage;
- tactics of radiation examination for various syndromes of organ diseases



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-modern principles and results of radical and palliative treatment of malignant neoplasms
physical, biological, technical fundamentals of radiation therapy, the concept of dosimetry and its role in preparation for radiation therapy, radiation therapy methods, planning features and possible radiation reactions, management of patients in the post-radiation therapy period and prevention of radiation reactions;

Be able to:

- determine the indications and contraindications for each method of radiation diagnostics;
- to identify the method and technique of the study based on the materials of radiation studies;
to identify the image of all human organs and indicate their basic anatomical structures on radiographs, computer and MRI tomograms, sonograms, scintigrams.
- outline the volume and rational sequence of radiation studies in diseases of various organs;
- to issue a referral for radiation examination;
- identify the image of organs and indicate their main anatomical structures on radiographs, sonograms, computer and magnetic resonance tomograms, scintigrams;
- to distinguish the visualized norm from pathology;
- to formulate indications for conservative and surgical treatment.
- draw up a radiation therapy plan, determine indications and contraindications, based on anamnestic data, clinical picture, stage and histological nature of the tumor; choose the method of radiation therapy depending on the location of the tumor and determine the complications;

Own:

- Skills of emergency protection against ionizing radiation
- Skills in making a referral for radiation examination
- the skill of working with documents of radiation diagnostics, using hardware (negatoscope, fluoroscope, computer) - the basics of the skill of conducting differential diagnostics
- registration of the patient's referral to certain methods of radiation diagnostics to the appropriate department of the medical institution
- skills of drawing up a treatment plan, drawing up a topometric map, predicting and conducting radiation reactions.

1.2. The scope of the discipline and types of academic work

Form of education – full time

Academic plan for 2021-22	2-4 sems.	Total	
		in hours	in credits
Total labor intensity	1924 (91 groups)	138	3
Classroom works	1086	80	
Lectures	263	25	
Practical classes	823	55	
Independent work	419	29	
SIWT	419	29	
Type of final control			On-lineMCQ tests

1.3. Structure of Discipline



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Course	Semester	Number of credits	Number of academic hours		Students' work		Total hours
			Lecture	Practice lessons	Abstracts	Reports	
2	3	1	0	18	6	6	30
2	4	0,5	8	14	7	7	36
3	5	0,5	8	14	7	7	36
4	8	1	9	9	9	9	36
TOTAL		3	25	55	29	29	138

1.3.1. Thematic plan for studying the Discipline.

	The names of the sections and topics of the discipline (lectures and practical exercises)	Total hours for classroom				Educational competencies	Educational technologies used, teaching methods and methods	Forms of current and midterm progress control
		Lectures	Seminars	Abstracts	Reports			
	<u>Unite 1, 3rd semester</u>							
1	Topic 1 Introduction to radiology. History of Radiology. General overview and physical foundations of Med. Technique	-	2	0.5	0.5	<i>PK-1, PK-3, PK-5, PK-6, PK -10, PK -12,</i>	<i>VL</i>	<i>ERWS</i>



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						PK -18, PK -31		
2	TOPIC # 2: X-ray method. X-ray display of the organs of the chest, skull, spine and various bones and joints are normal.	-	2	0.5	0.5	PK-1, PK-3, PK-5, PK-6, PK -10, PK -12, PK -18, PK -31	VL,BS,R D,ACA, SG, IA,DLT	ERWS
3	TOPIC # 3: Computed tomography. CT imaging of the chest organs, parenchymal organs and bone structures of the body is normal.	-	2	1	1	PK -1, PK -3, PK -5, PK -6, PK -10, PK -12, PK -18, PK -31	VL,BS,R D,ACA, SG, IA,DLT	ERWS
4	TOPIC # 4: Magnetic resonance imaging. MR imaging of normal structures of the GM and various organs of the abdominal cavity (for examples of the gastrointestinal tract: liver, pancreas, hollow organs; UGS and Reproductive: kidneys, MP, ureters, urethra, uterus with appendages, prostate, gonads	-	2	1	0.5	PK -2, PK -3, PK -11, PK -12, PK -13, PK -14, PK -15, PK -16, PK -19	VL,BS,R D,ACA, SG, IA,DLT	ERW in SG with present ation
5	TOPIC # 5: Ultrasonic method. Ultrasound imaging of parenchymal and hollow organs in normal conditions (using the example of the	-	2	1	1	PK-2, PK-3, PK -11, PK -12,	VL,BS,R D,ACA, SG,ERW	ERW in SG with present ation



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	liver, kidneys, thyroid, mammary, pancreas and prostate; as well as the urinary and gallbladder, micro and macro-bed vessels)					PK -13, S PK -14, IA, DLT PK -15, PK -16, PK -19	
6	TOPIC # 6: Endoscopy. Classification of Endoscopy. Normal endoscopic display of the esophagus, stomach and duodenum.	-	2	0,5		PK-2, VL,BS,R PK-3, D,ACA, PK -11, SG,ERW PK -12, S PK -13, IA,DLT PK -14, PK -15, PK -16, PK -19	ERW in SG with presentation
7	TOPIC # 7: Radionuclide diagnostics. Normal radio anatomy and physiology of the musculoskeletal system	-	2	1	1	PK-2, VL,BS, PK-3, RD,A PK -11, CA,SG PK -12, ,ERWS PK -13, IA,DL PK -14, T PK -15, PK -16, PK -19	ERW in SG with presentation
8	TOPIC # 8: Interventional radiology. Contrasting. Types of contrasts. Angiography on the example of the study of the coronary arteries. Normal radio anatomy of the heart and great vessels	-	2	1	1	PK-2, VL,BS, PK-3, RD,A PK -11, CA,SG PK -12, ,ERWS PK -13, IA,DL PK -14, T PK -15,	ERW in SG with presentation



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						PK -16, PK -19		
9	Topic # 9. Hybrid rendering.	-	2	-	-	PK-2, PK-3, PK -11 PK -12 PK -13 PK -14 PK -15 PK -16 PK -19	VL,BS ,RD,A CA,SG ,ERWS IA,DL T	ERW in SG with presen tation
10	The final lesson number 10 is held in an online format students write an online test at test.edu.kg	-	-	-	-	Final test		
	<u>Total for the 3rd semester:</u>	<u>0</u>	<u>18</u>	<u>7</u>	<u>7</u>	<u>Differential credit, according to the sum of three criteria (Attendance, current, control scores)</u>		
Unite 2, 4 th semester								
1	Module No. 1. Radiation Diagnostics of the Cardiovascular System • Topic # 1. The beam display of the SS System is normal. • Topic No. 2. Radiation symptoms and syndromes of acquired pathology of the cardiovascular system. • Topic # 3. Radiation symptoms and syndromes of congenital	2	4	2	2	PK -2, PK -3, PK -11, PK -12, PK -13, PK -14, PK -15, PK -16, PK -18,	VL,BS, RD,AC A,SG, ERWS IA,DL T	Offlin e testing or SM metho d presen tation



	malformations of the cardiovascular system.					PK-19, PK -31		
2	Module number 2. • Topic # 4. Respiratory system RD is normal • Topic # 5. Radiation symptoms and syndromes of the respiratory system pathology	2	4	2	2	PK -2, PK -3, PK -11, PK -12, PK -13, PK -14, PK -15, PK -16, PK -18, PK-19, PK -31	VL,BS ,RD,A CA,SG ,ERWS IA,DL T	Offline testing or SM method presentation
3	Module number 3. • Topic # 6. Reproductive system RD is normal • Topic # 7.8. Radiation symptoms of pathology of the reproductive organs (small pelvis and mammary glands)	2	4	2	2	PK -2 PK -3 PK -11 PK -12 PK -13 PK -14 PK -15 PK -16 PK -18 PK-19, PK -31	VL,BS ,RD,A CA,SG ,ERWS IA,DL T	Offline testing or SM method presentation
4	Module number 4. • Topic # 9. RD of the endocrine system is normal (detailed analysis using the example of the Thyroid gland) Radiation symptoms of the most common pathology of other organs of the endocrine system	2	2	1	1	PK -2,	VL,BS, RD,A CA,SG ,ERWS IA,DL T	Offline testing or SM method



								presen tation
	<u>Result for the 4th semester:</u>	<u>8</u>	<u>14</u>	<u>7</u>	<u>7</u>	<u>Undifferentiated credit, the total result is set</u>		
	<u>Unite 2, 5th semester</u>							
5	Module # 5. RD of the central nervous system <ul style="list-style-type: none"> • Topic # 10. RD of the central nervous system is normal • Topic # 11. Radiation symptoms and syndromes of pathology of the nervous system 	2	4	2	2	PK -2, PK -3, PK -11, PK -12, PK -13, PK -14, PK -15, PK -16, PK -18, PK-19, PK -31	VL,BS, RD,A CA,SG ,ERWS IA,DL T	Offlin e testing or SM metho d presen tation
6	Module 6. RD MS <ul style="list-style-type: none"> • Topic # 12. RD of the musculoskeletal system is normal • Topic # 13. RD SM in pathology 	2	4	2	2	PK -2, PK -3, PK -11, PK -12, PK -13, PK -14, PK -15, PK -16, PK -18, PK-19, PK -31	VL,BS, RD,A CA,SG ,ERWS IA,DL T	Offlin e testing or SM metho d presen tation
7	Module 7. RD of gastrointestinal tract	2	4	2	2	PK -2, PK -3, PK -11,	VL,BS, RD,A CA,SG	Offlin e testing



	<ul style="list-style-type: none"> • Topic # 14. RD of the gastrointestinal tract in normal and pathological conditions • Topic # 15. RD of the hepatobiliary system in health and disease 					PK -12, ,ERWS PK -13, IA,DL PK -14, T PK -15, PK -16, PK -18, PK-19, PK -31	or SM metho d presen tation
8	<p>Module number 8. RD UGS</p> <p>Topic No. 16. RD of the urogenital system is normal</p> <p>Topic # 17. RD UGS in pathology</p>	2	2	1	1	PK -2, VL,BS, PK -3, RD,A PK -11, CA,SG PK -12, ,ERWS PK -13, IA,DL PK -14, T PK -15, PK -16, PK -18, PK-19, PK -31	O ffline testing or SM metho d presen tation
	<u>Result for the 5th semester:</u>	8	14	7	7	<u>Undifferentiated credit,</u> <u>the total result is set</u>	
<u>Unite 3, 8th semester</u>							
	<p>Topic # 1 Introduction to Radiation Therapy</p> <ul style="list-style-type: none"> • Lecture number 1. Introduction to RT. Physical foundations of RT. • Seminar # 1. Indications and contraindications for radiation therapy. 	2	2	2	2	PK-2, PK-3, PK -11, PK -12, PK -13, PK -14, PK -15, PK -16, PK -18,	Offline testing or SM metho d presen tation Offlin e testing or SM metho d presen tation



						PK-19, PK -31		
Topic # 2. Clinical radiobiology <ul style="list-style-type: none"> • Lecture number 2. Clinical radiobiology • Seminar # 2. Clinical radiobiology and dosimetry. Fractionation modes in radiotherapy. 	2	2	2	2	PK-2, PK-3, PK -11, PK -12, PK -13, PK -14, PK -15, PK -16, PK -18, PK-19, PK -31	Offline testing or SM metho d presen tation	Offline testing or SM metho d presen tation	
Topic # 3. External beam therapy. Brachytherapy. Lecture # 3 and Seminar # 3	3	3	3	3	PK-2, PK-3, PK -11, PK -12, PK -13, PK -14, PK -15, PK -16, PK -18, PK-19, PK -31	Offline testing or SM metho d presen tation	Offline testing or SM metho d presen tation	
Topic 4. Prevention and treatment of radiation reactions and injuries. Lecture # 4 and Seminar # 4	2	2	2	2	PK-2, PK-3, PK -11, PK -12, PK -13, PK -14,	Offline testing or SM metho d	Offline testing or SM metho d	



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						PK -15, <i>presen</i> PK -16, <i>tation</i> PK -18, PK-19, PK -31	<i>presen</i> <i>tation</i>	<i>presen</i> <i>tation</i>
	<u>Result for the 8th semester:</u>	9	9	9	9	<u>Undifferentiated credit, the total result is set The final test is written online at test.edu.kg</u>		

1.3.2. Organization of Student's Individual Work

	<i>Theme of the students' work</i>	<i>Tasks</i>	<i>References</i>	<i>Deadli ne (week number)</i>
	<u>Unite 1, 3th semester</u>	Presentation only in PPT format Working with MG / in total for elaboration of 1 PPT 12 diagrams are given, volume of study of 1 question = 4 diagrams, thesis text, work with a virtual visual editor is required, the maximum possible 5 points are estimated: 1. Timeliness of the task 2. Adequacy of elaboration / correspondence of diagrams and text to the question posed 3.number of professional descriptive terms 4.information richness		
1	<u>Themes and questions of practice lessons I:</u> 1. Types of radiation used in radiation diagnostics. 2. Quantum and corpuscular radiation, their properties.	• History of radiology: 1) -Discovery of X-rays and radioactivity 2) - ultrasound 3) - the history of the appearance of CT	1. Radiobiology for the radiologists / Eric J. Hall, Amatto J/ Giaccia /2019 Wolters Kluwer (over 1000pages)	One work week 41



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	<p>3. What kind of radiation are ionizing, their types and properties. 4. What kind of radiation are non-ionizing, their types and properties. 5. Discovery and determination of natural and artificial radioactivity. 6. Deterministic and stochastic and radiobiological effects. 7. Principles and methods of protection against ionizing radiation. 8. Methods of clinical dosimetry. 9. Basic values of clinical dosimetry.</p>	<p>4) -MRI 2. Electromagnetic spectrum of rays, parameters (wavelength and frequency): 1) - alpha, beta particles, 2) -gamma- and x-rays 3) -infrared and radio frequency spectrum 4) -Ultrasonic and magnetic waves In each of the four cases, a description of the harmful properties and methods of protection of the population / health workers of radiological departments 3. Comparative-descriptive analysis of anatomical patterns / normal radiographs: 1) - organs of the chest 2) - femur 3) -healthy adolescent knee joint 4) -cervical spine</p>	<p>Section I &... (watch content!) 2. Review of Radiology Sumer K.Sethi 7th edition 2016 Pages from 1t, 301,316 3. History of radiology/ Adrian M. K.Thomas/ OXFORD university press2013 4. Clinical atlas of human anatomy (interactive) Elsevier eight edition 2020 Abrahams' & MCMINN's 5. RadiologyEducation: https://www.radiologyeducation.com/ 6. PubMed: https://www.ncbi.nlm.nih.gov/ 7. MedLine: https://www.nlm.nih.gov/ 8. Medscape: https://www.medscape.com/ 9. Radiopaedia: https://radiopaedia.org/</p>	
2	<p><u>Themes and questions of practice lessons 2:</u> 1. The history of the discovery of X-rays. 2. Properties of X-rays. 3. Sources of X-rays, the principle of their formation. 4. Interaction of X-rays with tissues, the principle of obtaining an X-ray image. 5. Terminology used to describe radiographs. 6. Methods of X-ray examination, their scope. 7. Differences between analog and digital methods.</p>	<p><i>Presentation, abstract</i> <i>Question 1:</i> 1) The basic structure of X-ray diagnostic devices 2) Requirements for placement, features of operation 3) Various types of X-ray techniques 4) Description of the basic diagram of obtaining an X-ray image and the design of the X-ray tube <i>Question2:</i> 1) Dose load of one diagnostic cystography procedure, description of the technique,</p>	<p>1. Radiobiology for the radiologists / Eric J. Hall, Amatto J/ Giaccia 2019 Wolters Kluwer (over 1000pages)Section I &... (watch content!) 2. Review of Radiology Sumer K.Sethi 7th edition 2016Pages from 1t, 301,316 3. Clinical atlas of human anatomy (interactive) Elsevier eight edition 2020 Abrahams' & MCMINN's</p>	43



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	<p>8. Advantages of the X-ray method. 9. Limitations of the X-ray method. Contraindications to X-ray diagnostic procedures.</p>	<p>indications / contraindications, patient preparation and research technique 2) Dose load of one diagnostic mammography procedure, description of the technique, preparation, indications / contraindications, technique 3) Dose load of targeted bronchography, description, preparation, indications and contraindications, technique 4) Dose load of one procedure of diagnostic hysteosalpingography. Description of the technique, indications and contraindications, preparation, technique Question3: Comparative-descriptive analysis of anatomical schematics / normal diagrams using the techniques from question 2: 1) bladder 2) bronchial tree 3) mammary gland 4) uterus and appendages</p>	<p>4. RadiologyEducation: https://www.radiologyeducation.com/ 5.PubMed: https://www.ncbi.nlm.nih.gov/ 6.MedLine: https://www.nlm.nih.gov/ 7.Medscape: https://www.medscape.com/ 8.Radiopaedia: https://radiopaedia.org/</p>	
3	<p><u>Themes and questions of practice lessons 3:</u> 1. The principle of obtaining an image in computed tomography (CT). 2. Terminology used to describe computed tomograms. 3. Varieties of computed tomography methods, their scope. 4. What is the Hounsfield scale, densitometric indicators of various tissues. 5. Technique of amplification in computed tomography. 6. Features of cone-beam computed tomography.</p>	<p>Presentation, abstract Question1: 1) a schematic diagram of the device of computed tomographs, the main blocks of a CT apparatus. Requirements for placement, features of operation. 2) Cone beam computed tomography in the study of the upper respiratory tract in three planes. Indications and contraindications for CBCT, description of the technique, technique 3) CT with contrast, on the example of the vessels of the</p>	The same	45



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	<p>7. Benefits of CT. 8. Limitations of CT and contraindications to its conduct.</p>	<p>heart. Indications, contraindications, description of the method, preparation, technique 4) MSCT of the left atrium with assessment of the pulmonary veins Indications, contraindications, description of the method, preparation, technique Question2: 1) Comparative analysis of analog-X-ray and digital CT of schematic diagrams of forming a diagnostic image 2) Methods of protection and control of the level of ionization / radiation in the active operating mode of the CT diagnostic device 3) The difference in methods for measuring the effective dose of radiation exposure and the radiation level of the environment / living and inanimate objects 4) What is low dose CT? Advantages and disadvantages of this technique, indications / contraindications Question 3: anatomical and radiological analysis 1) CT and skull bones 2) CT and cerebral vessels 3) CT and architectonic of the lungs 4) CT and contrasted urinary tract</p>		
4	<p><u>Themes and questions of practice lessons 4:</u> 1. The principle of obtaining an image in magnetic resonance imaging (MRI). 2. The process of obtaining T1 and T2 weighted images.</p>	<p>Presentation, abstract Question1: 1) The device of magnetic resonance imaging, their types. Requirements for placement, features of operation.</p>	The same	47



	<p>3. STIR and FLAIR MR imaging techniques. 4. Contrast agents used in MRI. 5. MRI techniques, their characteristics: Diffusion-weighted tomography, MR perfusion, MR spectroscopy, MR angiography, functional MRI, MR cholangiopancreatography. 6. Benefits of MRI. 7. Limitations of MRI. 8. Contraindications to MRI.</p>	<p>2) Medical thermography. Principle, methods, practical application. 3) Coronary angiography. 4) 3D tomosynthesis for the diagnosis of mammary glands. Question2: 1) MR contrasts 2) Difference between T1 and T2 weighted images 3) MR spectroscopy 4) MR-cholangiopancreatography Question3: 1) MRI and calf muscles 2) MRI and liver) 3) MRI and adrenal glands 4) MRI and the brain</p>		
5	<p><u>Themes and questions of practice lessons 5:</u> 1. The principle of formation of ultrasonic vibrations, their properties. 2. Principle of image formation using ultrasound. 3. Ultrasonic artifacts. 4. Terminology used to describe ultrasound images. 5. Ultrasound methods: 1D-echography (A- & M-modes); 2D - sonography (B-mode, 3 & 4D) 6. The principle of the Doppler method. 7. Pulsed and continuous-wave Doppler sonography, color. doppler mapping, power and tissue doppler. 8. Contrast agents used in ultrasound. 9. Benefits of ultrasound. 10. Limitations of ultrasound.</p>	<p><u>Presentation, abstract</u> Question1: 1) The device of ultrasound devices, their types. Requirements for placement, features of operation. 2) Elastography. Methodology, scope. 3) Echocardiography. Methodology of carrying out. 4) Doppler ultrasound of the neck vessels Question2: 1) Types of ultrasonic sensors, their differences, capabilities and limitations 2 The value of Doppler ultrasonography on the example of studying the veins of the lower extremity in the norm 3) ultrasound examination of the infant's GM norm 4) Ultrasound protocol for scanning the first trimester of pregnancy is normal Question 3: comparative analysis of ultrasound slices and related anatomical</p>	The same	47



		<p><i>diagrams of organs in the same projection</i></p> <ol style="list-style-type: none"> 1) ultrasound and liver / right kidney 2) ultrasound and spleen / left kidney 3) ultrasound and gallbladder with intra and extrahepatic biliary tract 4) ultrasound and urinary bladder with all urinary tract 		
6	<p><u>Themes and questions of practice lessons 6:</u></p> <ol style="list-style-type: none"> 1. The principle of obtaining images with the endoscopic method, 2. The device and types of endoscopes. 3. Methods of endoscopy, techniques. 4. Advantages of endoscopy. 5. Limitations of endoscopy. 	<p><i>Presentation, abstract</i></p> <p><i>Question1: Technique</i></p> <ol style="list-style-type: none"> 1) The device of a diagnostic endoscope for examining the hollow organs of the upper gastrointestinal tract, requirements for storage, operation 2) Types of modern endoscopy 3) List of procedures and instruments used in gastroduodenal endoscopy 4) a description of the technique for performing the procedure of endoscopic retrograde cholangiopancreatography <p><i>Question2: Technology</i></p> <ol style="list-style-type: none"> 1) pentax system 2) endoscopic hemostasis 3) limitations and contraindications for endoscopy 4) arthroscopy, technique <p><i>Question 3: comparative anatomical and radiological analysis</i></p> <ol style="list-style-type: none"> 1) walls / normal esophageal canal and endoscopic images of normal esophageal lumen 2) stomach 3) duodenum 4) ducts of the pancreas and common bile duct 	<i>The same</i>	49



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7	<p><u>Themes and questions of practice lessons 7/1:</u></p> <ol style="list-style-type: none"> 1. The concept of interventional radiology. 2. Types of endovascular interventional procedures. 3. Technique of angioplasty. 4. Technique for installing the cava filter. 5. Methods of interventional treatment of cerebral aneurysms. 6. Types of extravasal interventional procedures. 7. Fine needle aspiration biopsy (FNAB). 8. Percutaneous bone and joint surgery. <p><u>Themes and questions of practice lessons 7/2:</u></p> <ol style="list-style-type: none"> 1. Classification of X-ray contrast agents 2. Pr / indications for the use of different types of X-ray contrast agents. 3. X-ray contrast methods for studying the gastrointestinal tract. 4. X-ray contrast methods for studying the biliary tract. 5. X-ray contrast methods for studying the urinary system. 6. X-ray contrast methods for studying the reproductive system. 7. Methods of angiography. 	<p>Presentation, abstract</p> <p>Question1:</p> <ol style="list-style-type: none"> 1) Interventional procedures in cardiac surgery. 2) Interventional procedures in oncology. 3) Interventional procedures in urology. 4) Interventional procedures in neurosurgery. <p>Question2:</p> <ol style="list-style-type: none"> 1) Types of biopsy, indications, contraindications, technique, patient preparation 2) percutaneous intravascular plastic Indications, contraindications, patient preparation, technique 3) coblation - a technology for the restoration of the knee joint 4) Radiofrequency catheter ablation of cardiac arrhythmias, indications, contraindications, description of the technique, patient preparation, technique <p>Question 3: anatomical and radiological analysis</p> <ol style="list-style-type: none"> 1) physiology of the cardiac conduction system and Echo-KG in M mode, the norm 2) Endocardium and ultrasound, MRI images of the norm 3) The abdominal aorta and its branches are normal. Normal aortogram 4) coronary blood flow and coronary angiography are normal 	<p><i>The same sources + YouTube : cath.lab.org or cath.lab.com</i></p>	51
8	<p><u>Themes and questions of practice lessons 8:</u></p> <ol style="list-style-type: none"> 1. The principle of obtaining images in radionuclide diagnostics. 	<p>Presentation, abstract</p> <p>Question1:</p> <ol style="list-style-type: none"> 1) The layout of the PET apparatus, requirements for placement, features of operation. 	<p><i>The same</i></p>	53



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2. Requirements for radiopharmaceuticals (RFP), and their varieties.
3. The concept of the effective half-life (EPP).
4. Radiation safety for personnel and patients.
5. Methods of radionuclide diagnostics, their scope.
6. Scintigraphy.
7. Single-photon emission computed tomography.
8. Positron emission computed tomography.
9. Radioimmunological analysis (RIA).
10. Terminology used to describe scans and scintigrams.
11. Advantages of radionuclide diagnostics.
12. Limitations of radionuclide diagnostics.
13. Contraindications to radionuclide diagnostics.

- 2) Types of scintigraphy
 - 3) Dynamic thyroscintigraphy, characteristics and those requirements for the choice of contrast agent. Description of the procedure, preparation of the patient, indications and contraindications for
- Question2:**
- 1) classification of radiocontrast substances used for scintigraphy
 - 2) PET of the skeleton is normal, description of the technique, technique of execution, indications / contraindications, patient preparation
 - 3) the fundamental difference between analog and digital scintigraphy and the scheme for obtaining a scintigraphic image using the example of normal indicators of nephrography
 - 4) PET of the adrenal glands, description of the technique, execution technique, indications / contraindications, patient preparation
- Question 3: anatomical and radiological analysis**
- 1) Anatomy and physiology of the Thyroid gland / normal thyroid scintigram
 - 2) Anatomy of the Thoracic Aorta and its branches / dynamic scintigraphy of the thoracic aorta and its branches is normal
 - 3) Physiology of the Liver / Radionuclide Hepatography is normal



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		4) Normal CSF circulation / Static GM perfusion scintigraphy		
9	<p><u>Themes and questions of practice lessons 9:</u></p> <p>1. The concept of hybrid imaging. 2. SPECT / CT (PET / CT). Spheres of application. 3. FACT / CT (SPET / CT). Spheres of application. 4. PET / MRI imaging. Spheres of application. 5. Benefits of hybrid imaging. 6. Limitations of hybrid imaging.</p>	<p><u>Presentation, abstract</u></p> <p>Oral questioning, interviewing, defense of electronic abstracts on topics and questions of practical lesson 9</p>	<i>The same list</i>	55
	<u>Unite 2, 4th semester</u>	Tasks for abstract are made out in PPT format, - for small groups; and in the form of printed abstracts - individually, no more than 9 pages in volume, containing worked out material in the form of diagrams with pointers, diagrams and compressed text in the form of abstracts	<i>References</i>	<i>Deadline</i>
10	<p><u>Module 1, RD CVS</u></p> <p><u>Topics for studying module 1</u></p> <p>1. Modern methods of radiation diagnostics, their capabilities in detecting diseases of the cardiovascular system. 2. Normal radial anatomy of the cardiovascular system and age-related features of the structure of the heart. 3. Choose a method of radiation examination for pathology of the cardiovascular system. 4. To study the radial signs of morphological changes in the pathology of the heart and great vessels. 5. Radiation signs of acquired heart and vascular defects.</p>	<p>1. Arcs delimiting the shadow of the heart on the radiograph in the anterior direct projection (along the right and left contours). 2. Arcs limiting the shadow of the heart on the radiograph in the left lateral projection. 3. Diagnostic capabilities of echocardiography. 4. Standard accesses for echocardiography. 5. Diagnostic capabilities of computed tomography in the study of the heart and blood vessels. 6. Diagnostic capabilities of magnetic resonance imaging in the study of the heart and blood vessels.</p>	<p>1. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 1. The normal chest: methods of investigation and differential diagnosis Сtp.1-56 2. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 2. The normal heart: anatomy and techniques of examination Сtp. 265-282 3. David Sutton. Textbook of Radiology</p>	<i>FOR ALL MODULES - THREE DAYS BEFORE THE FINAL CLASS</i>



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6. X-ray picture in ischemic disease and its complications.
7. Radiation signs of congenital heart and vascular defects.
8. X-ray picture in congenital malformations with depletion of the pulmonary pattern:
9.a) isolated pulmonary stenosis
10.b) tetrad of Fallot: - narrowing of the pulmonary artery
11. Ventricular septal defect
12. "on top" seated aorta
13. hypertrophy of the right ventricle
14.c) Fallot's triad: - narrowing of the pulmonary artery
15. Atrial septal defect
16. hypertrophy of the right ventricle
17. X-ray picture with congenital defects with increased pulmonary pattern:
a) atrial septal defect
b) ventricular septal defect
c) patent ductus arteriosus.
18. Algorithm of radiation examination and the main radiation symptoms of stenoses and occlusions of blood vessels, aneurysm, varicose veins and arteries (aorta, inferior vena cava, vessels of the extremities, brain).
19. Post-traumatic changes in blood vessels.
20. Recognize the borders of the heart and aorta on radiographs, their structural anatomical elements.
21. Recognize the shape of the heart and blood vessels.
22. Determine the function of the chambers of the heart and cardiac septa, as well as the great vessels.

7. Radionuclide studies of the heart.
8. Types of interventional vascular interventions.
9. How is the cardiometry performed on the plain chest x-ray, the values.
10. How is the measurement of the Moore index on the plain chest x-ray, its value.
11. Techniques for conducting angiocardiology, coronary angiography and aortography, their purpose.
12. Radiation signs of diseases of the heart and large vessels.
13. Radiation signs and violation of hemodynamics in the mitral form of the heart.
14. Radiation signs and hemodynamic disturbance in aortic heart shape.
15. Radiation signs and diseases leading to the formation of a trapezoidal heart shape.
16. Radiation signs of congenital heart defects.

and Imaging. (Seventh edition), 2003. Volume 2. Section 2. Acquired heart disease I: the chest radiograph. Стр. 283-316
4. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 2. Acquired heart disease II: non-invasive imaging. Стр. 317-346
5. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 2. Invasive imaging and interventional techniques. Стр. 347-362
6. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 2. Arteriography and interventional angiography Стр. 411-482
7. Clinical Atlas of Cardiac and Aortic CT and MRI. Springer 2019. Editors: Patricia M. Carrascosa, Carlos M. Capunay, Alejandro Deviggiano, Gaston A. Rodrigues-Granillo
8.
9. Radiology Education on: <https://www.radiologyeducation.com/>
10. PubMed: <https://www.ncbi.nlm.nih.gov/>
11. MedLine: <https://www.nlm.nih.gov/>



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23. Recognize the methods of radiation diagnostics from the presented images.

24. Determine the shape of the heart on radiographs in various diseases (aortic and mitral configuration).

25. Recognize X-ray signs of heart defects and changes in the configuration of the heart on radiographs.

Questions for module №1

1. What method of radiation diagnostics is the main one in the study of the heart and blood vessels.

2. What is the general roentgen semiotics of heart and vascular disease (draw changes in the configuration of the heart and the state of the pulmonary pattern, and give them an explanation).

3. What method is objective in the study of the contractile function of the heart segments.

4. What method is the most informative in the study and diagnosis of congenital heart defects.

5. What method of radiological diagnostics can reveal defects of the interventricular and interatrial septa.

6. What methods are used, in addition to radiation, to determine defects of the interventricular and interatrial septa.

7. What is the most informative method for determining aneurysms of arteries and veins.

8. Which method is the most informative for identifying adynamic zones of the ventricles, that is, areas with no contractions, which is typical

12. Medscape:

<https://www.medscape.com/>

13. Radiopaedia:

<https://radiopaedia.org/>

12. Crack the Core Exam - Case Companion

First Ed. - Version 1.12015 by Prometheus Lionhart

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	for post infarction cardiosclerosis.			
1 2	<p><u>Module 2, RD of Respiratory system</u></p> <p><u>Topics for studying module 2</u></p> <p>1. Stages of analysis of chest x-ray.</p> <p>2. The sequence of characteristics of the isolated X-ray symptom of pathology.</p> <p>3. What pathological processes in the lung tissue, pleural cavity can cause syndromes of total, subtotal blackout, limited blackout?</p> <p>4. On what grounds is the differential diagnosis of total, subtotal and limited obscuration based?</p> <p>5. What are the radiological signs of a decrease in lung volume?</p> <p>6. X-ray picture of the syndrome of total, subtotal, limited darkening in pneumonia, atelectasis, exudative pleurisy.</p> <p>7. What pathological processes in the lung tissue and what diseases cause syndromes of focal shadow, limited and widespread dissemination, round and annular shadow?</p> <p>8. On what X-ray morphological and clinical signs is the differential diagnosis of these syndromes based?</p>	<p>Task 1. Patient D., 44 years old, with fluorography revealed a symptom of a round shadow. What should be the algorithm of methods and techniques of ray research to establish the nature of this shadow?</p> <p>Task 2. On radiographs and tomograms of the chest cavity of patient T., 67 years old, multiple bilateral round shadows are revealed, the number of which increases towards the diaphragm, their contours are even, up to 1 cm in diameter, do not merge, the structure is homogeneous. The roots on both sides are expanded due to enlarged lymph nodes, structural, polycyclic. Conclusion: pulmonary tuberculosis. Do you agree with this conclusion; on what basis do you confirm or deny it?</p> <p>Task 3. On the roentgenograms and tomograms of the chest cavity organs of the patient 3., 48 years old, atelectasis of the middle lobe in the form of a darkening of a heterogeneous structure was found. In the adjacent segments, a strengthened and deformed pulmonary pattern is visible. On the bronchograms on the</p>	<p>David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 1. The normal chest: methods of investigation and differential diagnosis Сtp.1-56</p> <p>1. RadiologyEducation: https://www.radiologyeducation.com/</p> <p>2. PubMed: https://www.ncbi.nlm.nih.gov/</p> <p>3. MedLine: https://www.nlm.nih.gov/</p> <p>4. Medscape: https://www.medscape.com/</p> <p>5. Radiopaedia: https://radiopaedia.org/</p> <p>6. A-Z of Chest Radiology</p>	



9. X-ray picture of focal shadow syndrome, limited and widespread dissemination.
10. X-ray picture of the syndrome of a round and annular shadow.
11. X-ray picture of the syndrome of extensive enlightenment.
12. Name the main differential diagnostic sign of pneumothorax, chronic vesicular emphysema.
13. What types of pneumothorax do you know due to the origin and development mechanism?
14. X-ray picture in root pathology syndrome.
15. Violation of bronchial patency. Development phases and X-ray picture.
16. How does the development of symptoms of impaired bronchial patency depend on tumor growth?
17. In what diseases is there a bilateral root lesion?
18. What lung diseases can be associated with root pathology syndrome?

Questions for module 2

1. Varieties of anomalies in the development of the lungs and their radiological manifestations.
2. Features of X-ray diagnostics of acute pneumonia in children.
3. The shadow picture in various forms of acute pneumonia in adults, the algorithm for the use of radiation methods and techniques and their information content in

right, SIV_V segments contrasted along the entire length of the bronchi are visible, they are drawn together, shortened, and have the appearance of a "beaded cord". What should be the conclusion on the above picture?

Task 4. On the roentgenograms of the chest cavity in patient J., 25 years old, pathological symptoms are determined that cause suspicion of enlargement of the mediastinal lymph nodes. Suggest techniques and methods of radiation diagnostics that would clarify the above suspicion.

Task 5. On radiographs of the chest cavity of patient JL, 44 years old, total darkening is determined on the right, which has a high intensity, homogeneous structure, the shadow of the mediastinum is displaced to the left. What, in your opinion, is the reason for the described picture?

Task 6. In patient A., 24 years old, an X-ray examination of the chest cavity organs in the left pleural cavity revealed a liquid in the form of a high-intensity uniform darkening, the lower contour of which merges with the diaphragm, the mediastinum is displaced in the opposite direction. In which cases will the upper boundary of the liquid have an oblique level, and in which - horizontal?

Task 7. During fluoroscopy of the chest cavity in patient D., 36 years old, a round shadow,



identifying pathological changes.

4. Features of the X-ray picture in different phases of development of the echinococcal cyst of the lung.

5. X-ray diagnostics of destructive pneumonia in children.

6. Some diagnostic aspects of X-ray detection of abscess and abscess pneumonia.

7. Computed and X-ray tomography in the diagnosis of central lung cancer and its regional metastases.

8. Differential X-ray diagnostics of round shadows in the lungs.

9. X-ray manifestations of chronic pneumonia.

10. Radiation diagnostics in the identification and assessment of the nature of intrabronchial and extra-bronchial benign tumors.

11. Differential X-ray diagnostics of pulmonary dissemination.

12. Fluorography and tomography in the assessment of various forms of pulmonary tuberculosis.

13. Informativeness of radiation methods in the diagnosis of tumors and cysts of the mediastinum.

14. X-ray diagnostics of pleural diseases.

medium intensity, heterogeneous structure, up to 2 cm in diameter is found on the right, its contours are clear, but uneven. The connection of the shadow with the tail part of the root is noted. There is a suspicion of the vascular nature of this formation (angioma). Prescribe an X-ray examination technique that will help to give the correct conclusion based on the additional symptoms received (which ones?).

Task 8. On radiographs of the chest cavity organs in frontal and lateral projections of patient U., 69 years old, a pathological hemispherical shadow with an external uneven radiant contour is determined in the right root. On additionally produced tomograms it can be seen that the bronchi passing through the shadow are not changed. What causes the shadow at the root: central exobronchial cancer or enlarged lymph nodes?

Task 9. During the initial X-ray examination of patient D., 57 years old, in the left lung in the SVI, a symptom of a “round shadow” is found, up to 5 cm in diameter, the contours are indistinct. One gets the impression of peripheral cancer complicated by paracancerous pneumonia, since there are clinical signs of inflammation (fever, cough, leukocytosis). After anti-inflammatory therapy, 1 week later, with control



radiography, the round shadow turned into a ring-shaped one, i.e. decay has occurred in the form of a clearing cavity, which has a central location, the walls of the cavity are uneven, indistinct, the cavity contains a large amount of liquid, on the tomograms the tuberosity of the contours and partitions in the cavity is not determined. Did the nature of the decay change your initial impression of the pathological process?

Task 10. Patient M., 43 years old, who came from a village where he has his own farm (dogs, chickens, a cow, etc.), had X-rays of the chest cavity organs taken in two projections due to low-grade fever and cough. On the right, in Svm, an oval-shaped ring-shaped shadow with dimensions of 3x4.5 cm was found, the contours are clear, even, the cavity wall is thin, uniform, contains a horizontal liquid level, under which an additional irregular shadow is determined that moves when the body position changes. Conclusion: an opened abscess. Do you agree with the conclusion?

2 **Module 3, RD of Reproductive system**

Topics for studying module 3
Radioisotopic detailed description of the anatomy of the organs of the reproductive system, using data from ultrasound, MRI, CT, hysterosalpingographic indicators of norms, in

Presentation, essay, work in small groups

1. Ultrasound examination of the pelvic organs. Patient preparation, technique, ultrasound slices during the examination procedure. Parameters of normal endometrium, uterus and ovaries on the 5-7th day of the

1. Imaging anatomy: chest, abdomen, pelvis, second edition Copyright © 2017 by Elsevier Editors: Michael P. Federle, MD, FACR and colleagues....
2. The Official Internet site «Radiologyeducation.co

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comparison with various age and cycle changes in the female body. Description of the phases of the menstrual cycle and the importance of physiological processes for correct diagnosis and accurate diagnosis, on the examples of comparing inflammatory processes of the mammary gland, ovarian cysts with mastopathy and physiological development of graphium follicles
 Radiation signs of the main diseases of the reproductive system:
 A. Radiological symptoms of inflammatory diseases.
 B. Radiological symptoms of benign masses
 C. Radiation symptoms of congenital malformations of the reproductive system (introductory level)

Pregnancy. Establishing the fact of pregnancy. Key visual points in determining the normal development of the fetus Determining the sex of the unborn child. Fetal development by trimester. Physiological pregnancy. Ultrasound identification of the fact of pregnancy, ultrasound signs of an early stage of pregnancy. Key ultrasound indicators of the norm for all trimesters of pregnancy. Days of ultrasound screening, assessment of the norm for the most important indicators of the mother and fetus. Placental-uterine interaction. The dynamics of the development of the placenta in the ultrasound assessment. Hormone tests that

menstrual cycle. Distinctive ultrasound parameters of endometritis, cicatricial changes in the uterus (cesarean section), topographic position, options for the norm of position, signs of a pregnant uterus on ultrasound. Infantilism of the reproductive system and its ray signs.
 2. Anatomy and physiology of the fallopian tubes. The imaging of the fallopian tubes on the sonogram in normal and pathological conditions. MRI and X-ray hysterosalpingography. Indications and contraindications. Technique, complications, limitations. The state of tubal patency is normal and with various types of pathology.
 3. Comparative analysis of radiation data of mastitis and mastopathy in conjunction with clinical and laboratory data.
 4. Amniocentesis. Determination of the methodology, technique. Indications and contraindications. Possibilities and limitations of this type of research. Finds.
 5. Ultrasound examination of the mammary glands. Significance of palpation prior to examination. Description of breast sonography technique. The ratio of the tissues of the gland in accordance with age-related changes. Radiation signs of mastitis, mastopathy and fibro adenoma.

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 3. Clinical Sonography. A practical guide 5th edition © 2016 Wolter Kluwer Roger Sanders. Barbara Hall Terracciano
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determine the condition of the placenta.
 Pathological pregnancy. Ectopic pregnancy, ultrasound signs. Radiation signs of fetal underdevelopment, genetic and chromosomal abnormalities. Infections. Toxoplasmosis. Intrauterine fetal death. Ultrasound signs. The risk of termination of pregnancy. Ultrasound signs and hormonal tests.

Radiation picture of the mammary glands with ultrasound, mammography, ductography, pneumocystography
 Mastitis during breastfeeding. Ultrasound assessment of the patency of the milk ducts, regional lymph nodes, Doppler data.
 Mastopathy. Breast Cancer Control Program. Risk groups, preventive measures.

Questions for module 3

Radioisotopic detailed description of the anatomy of the organs of the reproductive system, using data from ultrasound, MRI, CT, hysterosalpingographic indicators of norms, in comparison with various age and cycle changes in the female body. Description of the phases of the menstrual cycle and the importance of physiological processes for correct diagnosis and accurate diagnosis, on the examples of comparing inflammatory processes of the mammary gland, ovarian cysts with mastopathy and

6. First trimester of pregnancy. Full description of sonographic screening
7. Second trimester. Key parameters for the normal development of the fetus and physiological changes in the uterus.
8. Third trimester. Sonographic description of the development of intrauterine life, State of the placenta. Her pathological changes.
9. Pathological signs of pregnancy development typical for the first trimester of pregnancy
10. Diagnosis of fetal heart defects. Fetal circulation. Physiological changes in the baby's bloodstream in the postnatal period. Comparative analysis of hemodynamic parameters based on Doppler measurements.

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 1. ultrasonography in obstetrics and gynecology, sixth edition. 1600 John F. Kennedy Blvd. Ste 1800 Philadelphia, © 2017 by Elsevier, Inc. All rights reserved.
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 4. PubMed: <https://www.ncbi.nlm.nih.gov/>
 5. MedLine: <https://www.nlm.nih.gov/>
 6. Medscape: <https://www.medscape.com/>
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physiological development of graphium follicles
 Radiation signs of the main diseases of the reproductive system:
 A. Radiological symptoms of inflammatory diseases.
 B. Radiological symptoms of benign masses
 C. Radiation symptoms of congenital malformations of the reproductive system (introductory level)
 Pregnancy. Establishing the fact of pregnancy. Key visual points in determining the normal development of the fetus Determining the sex of the unborn child. Fetal development by trimester. Physiological pregnancy. Ultrasound identification of the fact of pregnancy, ultrasound signs of an early stage of pregnancy. Key ultrasound indicators of the norm for all trimesters of pregnancy. Days of ultrasound screening, assessment of the norm for the most important indicators of the mother and fetus. Placental-uterine interaction. The dynamics of the development of the placenta in the ultrasound assessment. Hormone tests that determine the condition of the placenta.
 Pathological pregnancy. Ectopic pregnancy, ultrasound signs. Radiation signs of fetal underdevelopment, genetic and chromosomal abnormalities. Infections. Toxoplasmosis. Intrauterine fetal death. Ultrasound signs. The risk of termination of pregnancy.

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Ultrasound signs and hormonal tests.

Radiation picture of the mammary glands with ultrasound, mammography, ductography,

pneumocystography

Mastitis during breastfeeding.

Ultrasound assessment of the patency of the milk ducts, regional lymph nodes, Doppler data.

Mastopathy. Breast Cancer Control Program. Risk groups, preventive measures.

Questions for module 3

1. What radiation methods are used to study the mammary glands, their capabilities and limitations.

2. Specify the optimal days of the menstrual cycle for diagnostic mammography.

3. Radiation symptoms of benign and malignant formations in the mammary gland during mammography.

4. Radiation symptoms of benign and malignant formations in the mammary gland by ultrasound.

5. Radiation symptoms of benign and malignant formations in the mammary gland during magnetic resonance mammography.

6. Which method is the most informative for examining the pelvic organs - CT or MRI? Explain why.

7. What method of radiological diagnosis is used to control the biopsy of the prostate gland?



8. The term for the appearance of the ovum, its ultrasound picture.
9. The timing of the appearance of structures and organs of the fetus.
10. Basic parameters of fetal ultrasound biometrics.
11. Tasks of ultrasound in the first trimester of pregnancy.
12. Tasks of ultrasound in the II trimester of pregnancy.
13. Tasks of ultrasound in the II-I trimester of pregnancy.
14. What is the use of Doppler ultrasonography of a pregnant woman?
15. What radiation methods are used to study the uterus and appendages, their capabilities and limitations.
16. What radiation methods are used to study the reproductive system of men, their capabilities and limitations.
17. Features of the use of radiation methods for the study of the reproductive system of children.
18. Metrosalpingography technique, indications and contraindications, normal radiation pattern.

Module 4, RD of Endocrine system

Topics for studying module 4

Normal ultrasound anatomy of the thyroid gland. Comparison of the morphological, functional and visual components in the ultrasound image.

US-Topographic ratio of the displayed structures. Gland detection markers on transverse and longitudinal sonogram.

Presentation, abstract

1. A complete description of the technique for conducting ultrasound examination of the thyroid gland. Topographic position, shape, size, normal organ texture, gland contours, displacement, sensitivity, blood supply, assessment of regional l / nodes.
2. Ultrasound semiotics of nodular goiter. The texture of the altered gland, Doppler

Atlas of thyroid ultrasonography. Springer 2017. Editors Milan Halenks & Zdenek Frysak
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1. Imaging Anatomy: Chest, Abdomen, Pelvis, Second Edition Copyright

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Muscles surrounding the thyroid gland in transverse and longitudinal ultrasound sections. Iodine metabolism: intra- and extra-organ. Thyroid hormones and their biological effects.

Gamma scintigraphy of the thyroid gland. Preparing the patient for the study. Scintigraphic norm in dynamics. Possibilities and limitations of the scintigraphic technique.

Radiological syndromes of thyroid lesion:

A. Radiological syndrome of hyperthyroidism. Nodal and Diffuse form.

B. Radiological syndrome of hypothyroidism. Primary, secondary, tertiary and iodine deficiency hypothyroidism.

C. Radiological syndrome of a benign thyroid tumor.

D. Radiological syndrome of a malignant tumor of the thyroid gland.

Lateral craniogram is normal and its importance in assessing the state of the pituitary gland.

Pituitary adenomas, pituitary pathology syndromes.

Adrenal glands, pancreas. MRI anatomy, the possibilities of ultrasound in the assessment of tissue structures of these organs.

1st theme: Radiation symptoms and syndromes of endocrine system pathology.

1. Hyperthyroidism diffuse and nodular goiter. Ultrasound picture of changes. Doppler data. Comparative analysis of data in comparison with the morphofunctional norm.

data. Clinical data in correlation with morphological and functional changes.

3. Gamma Scintigraphy. Preparation of the patient and its time scale for an adequate assessment of the functional status of the organ. Assessment of research results.

4. Scintigraphy and ultrasound signs of diffuse hyperthyroidism, comparative analysis with Hashimoto's thyroiditis.

5. Description of the technique of fine-needle biopsy to exclude the cancerous nature of the node in the thyroid gland.

6. Signs of thyroid cancer. in the semiotics of various techniques (MRI, CT, ultrasound, Doppler, scintigraphy).

7. Radio anatomy of the adrenal gland. Complete MRI description of the structural component of the adrenal glands.

8. Pathology of the adrenal glands, radio semiotics of the most typical diseases of benign nature.

9. The value of lateral craniography in the detection of hypertrophic processes of the pituitary gland

10. Sheen's syndrome. Pathogenetic description, diagnostics, MRI data.

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2. Atlas of thyroid ultrasonography. Springer 2017. Editors Milan Halenks & Zdenek Frysak

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Hashimoto's autoimmune tereoiditis. Grayscale ultrasound and Doppler findings. Specificity of visual changes in comparison with hyperthyroidism.

2. Subacute de Quervain's thyroiditis. The transition from a hypothyroid state to a hyperthyroid state. Ultrasound, Doppler and laboratory-clinical analysis.

3. Fibro adenoma of Shch.Zh. symptom of "vascular ring" diff. diagnostics with malignant processes. ...

4. A brief general overview of various pathologies of the endocrine system.

A. Pathology of the pituitary gland: Acromegaly. Prolactinoma. Cushing's Syndrome. Apoplexy of the Pituitary Gland.

B. Diseases of the adrenal glands: Insulinoma. Conn's Syndrome. Addison's disease. Pheochromocytoma.

Questions for module 4

1. Radiation methods for studying the organs of the endocrine system in children and adults.

2. Radiation anatomy of the thyroid gland, pituitary gland, parathyroid glands, thymus, adrenal glands.

3. Indications for conducting radiation studies of the endocrine glands.

4. X-ray research methods: determination of bone age, Turkish saddle with pituitary adenomas, osteoporosis with hypercortisolism, diabetes mellitus.

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5. Radioisotope imaging of the endocrine glands in the syndrome of hyperthyroidism and the syndrome of hypothyroidism. Test of absorption of ⁹⁹Tc - pertechnetate, ¹³¹-iodine, ¹²³-iodine.
6. Methods of visualization of the adrenal glands in the syndrome of insufficiency of the adrenal cortex: sonography, CT, scintigraphy with ¹³¹iodine-cholesterol.
7. Radiation examination of the pituitary gland in the syndrome of insufficiency of the function of the pituitary gland. Diagnosis of pituitary adenoma using MRI, CT, skull X-ray.
8. Radio immunological analysis of the content of hormones in the blood.
9. Radiation symptoms of pancreatic pathology.
10. Identification of clinical and radiation syndromes.

Unite 2, module 5

Module 5: RD of CNS

Topics for studying module 1

Radiation anatomy of the skull and brain.
Injuries to the skull and brain. Mass effect. Types of hematomas.
Cerebral circulation disorders, stroke. Infectious and inflammatory diseases of the brain and spinal cord. Hypertensive syndrome. Tumors of the skull and brain. Radiation anatomy of the spine and spinal cord. Spine and spinal cord injuries. Vertebral pain syndrome.

Questions for module 5:

Presentation, abstract

1. Most common congenital abnormalities of CNS most common CNS abnormalities
2. Trauma of head head injury
3. Infections Infections
4. Inflammatory conditions - inflammatory processes
5. Neoplastic diseases (astrocytoma, glioma) glioma and astrocytoma
6. Vascular disorders (insult, ischemia) cerebral aneurism. Circulatory disorders, cerebral aneurysm
7. Degenerative conditions (cortical necrosis and role of it for human life quality)

1. Emergency Radiology. (for NS) Second Edition by Jorge A. Soto, MD., Brain C. Lucey MD. Elsevier, 2017
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	<p>Degenerative processes: cortical necrosis and its role in changing the patient's quality of life</p> <p>8. Metabolic and toxic conditions of brain metabolic and toxic disorders of the brain</p> <p>9. Hydrocephaly Hydrocephalus</p> <p>10. Glioma. Astrocytoma</p> <p>11. Prolactinoma</p>		
<p>5</p> <p><u>Module 6: RD of Musculoskeletal system</u> Radiation diagnostics of the musculoskeletal system. Theme 1. Radiation diagnosis of traumatic, inflammatory and degenerative changes in the musculoskeletal system. Types of fractures, dislocations, displacements. Algorithm for describing fractures. Soft tissue injuries. Features of fractures in childhood.</p>	<p><i>Presentation, abstract</i> <i>Small group work PPT</i></p> <p>1. The role of the X-ray method in the recognition of skeletal lesions. 2. Indications and contraindications for X-ray examination of the skeleton. 3. Diagnostic capabilities of ultrasound, computed tomography (CT) and magnetic resonance imaging (MRI), scintigraphy in the</p>	<p>References: <i>Main References:</i> 1. Imaging anatomy: chest, abdomen, pelvis, second edition Copyright © 2017 by Elsevier Editors: Michael P. Federle, MD, FACR and colleagues.... 3. Emergency Radiology. (for NS) Second Edition by Jorge A. Soto, MD., Brain C. Lucey MD. Elsevier 2017</p>	<p>15</p>



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Degenerative diseases. Typical imaging findings for osteoarthritis and degenerative changes in the spine and joints. Inflammatory / infectious diseases. Pathophysiology of inflammatory diseases of the musculoskeletal system, the main imaging criteria in the diagnosis of arthritis, osteomyelitis and spondylitis; differential diagnosis of the most common inflammatory diseases.

Theme 2. Benign and malignant lesions of the musculoskeletal system.

Radiation signs of the differentiation of benign and malignant skeletal lesions. Types of periostitis. Metabolic / endocrine bone diseases. Tumors and soft tissue injuries. Interventional orthopedic procedures.

Questions for module 6:

1. Features of fractures in children and the elderly.
2. Complications of bone fractures detected by X-ray examination.
3. Osteochondrosis and deforming spondylosis (X-ray anatomical parallels).
4. Bone cyst as a pathology of childhood, its roentgen semiotics
5. Early and late radiological manifestations of osteomyelitis,
6. General and distinctive signs of purulent and tuberculous arthritis
7. Rheumatoid arthritis (clinical and radiological manifestations).

study of the musculoskeletal system.

4. X-ray anatomy of bones and joints, age-related features of the skeleton, displayed on radiographs.
5. The main radiological symptoms of injuries and diseases of the musculoskeletal system.
6. Scheme of the analysis of the X-ray of the skeleton.
7. Methods for determining osteoporosis, its criteria and types.
8. Types of periostitis.
9. X-ray symptoms of the fracture.
10. Terms of callus formation, their X-ray characteristics;
11. Features of fractures in childhood.
12. Complications of fractures, their radiological signs.
13. Focal lesions of bones, their radiation manifestations.
14. Systemic bone lesions, their radiation manifestations.
15. Radiation signs of damage to the ligamentous apparatus and muscles.
16. Radiation signs of benign bone diseases.
17. Radiation signs of malignant bone diseases.

5. The Official Internet site

«Radiologyeducation.com» - Curated by Michael P.D'Alessandro, MD.

6. Clinical Sonography. A practical guide 5th edition © 2016 Wolter Kluwer Roger Sanders. Barbara Hall Terracciano

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8. Various forms of benign bone tumors in the X-ray image.
 9. Roentgen semiotics of Ewing's tumor.
 10. Radio semiotics of osteoblastic and osteoblastic capcoma.
 11. X-ray diagnostics of various types of bone metastases.
 12. Clinical and radiological semiotics of myeloma.
 13. Osteochondropathy (different forms in radiological manifestation).
1. What kind of methods of radio diagnosis apply in skeleton diseases?
 2. Indicate the age of appearance focus of bone and age of synostosis?
 3. How many bones has adult person?
 4. What kind of tubular bones' parts we can see on the x-ray films?
 5. Body of tubular bone is
 6. In what form emerges joint {cartilage} space on radiogram?
 7. What is the difference on the X-ray image of flat bone from the image of long bone?
 8. What methods are most effective for researching muscles and soft tissues, ligamentous apparatus?
 9. What does it mean "hyperostosis", and its causes? Atrophy and its causes? Osteophyte and its causes?
 10. Whether can we see periosteum in the theory on radiograph?
 11. What kinds of periostitis do you know?



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12. What types of bones' structural changing mainly do you know in case of fractures?
13. What kinds of osteoporosis do you know?
14. What are the x-ray signs of the gunshot wound?

Module 7, RD of Gastrointestinal tract

Theme 1:

Radiation anatomy and physiology of the esophagus. Barium contrasting. Radiation diagnosis of diseases of the esophagus (foreign bodies of the pharynx and esophagus, burns, diverticula, dyskinesia, hiatal hernia, esophagitis and esophageal ulcers, achalasia, esophageal tumors).

Radiation anatomy and physiology of the stomach and duodenum. Radiation diagnostics of diseases of the stomach and duodenum (gastritis, peptic ulcer, stomach cancer, benign stomach tumors).

Radiation anatomy and physiology of the small and large intestine. Radiation diagnosis of diseases of the small and large intestine: dyskinesia, inflammatory diseases, malabsorption syndrome, benign and malignant tumors. Mechanical and dynamic intestinal obstruction.

Theme 2. Radiation diagnostics of the liver, gallbladder, pancreas and spleen.

Radiation methods for studying the liver and biliary tract.

1. Differential X-ray diagnostics of esophageal cardiospasm and cardioesophageal cancer.

2. Roentgenosemiotics of types of diaphragmatic hernias.

3. Differential and diagnostic aspects of narrowing of the esophagus according to X-ray examination.

4. Differential X-ray diagnostics of benign and malignant gastric ulcer.

5. Methods of X-ray examination in the diagnosis of polyposis of the stomach and intestines.

6. Radiosemiotics of exophytic forms of gastric cancer.

7. Comparative efficiency of X-ray and endoscopic research methods in the diagnosis of infiltrative forms stomach cancer.

12. X-ray diagnosis of duodenal bulb ulcer and its complications.

13. Technology of X-ray examination in case of pylorus stenosis and determination of its cause.

14. Methods of X-ray examination and X-ray semiotics of gastrointestinal diverticula and their complications.

References:

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2. Musculoskeletal imaging. Fourth edition. B.J.Manaster. David A. May & David G. Disler Mosby Elsevier Saunders. 2013

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Preparing the patient for research. Radiation anatomy of the liver, biliary tract, pancreas, spleen. Radiation pattern of liver and biliary tract lesions: diffuse and focal liver lesions, parasitic diseases, fatty hepatosis, liver cirrhosis, portal hypertension. Cholelithiasis. Radiation differentiation of acute and chronic cholecystitis.

Questions for module 7:

1. What research method is better for revealing folds of the esophageal mucosa?
2. A symptom of what syndrome is a rounded formation with a tuberos surface growing into the lumen of the colon?
3. How do the folds of the mucous membrane change with the symptom of filling defect of malignant genesis in the gastrointestinal tract?
4. How do the folds of the mucous membrane change with a symptom of a benign filling defect in the gastrointestinal tract?
5. Non-invasive radiation methods for studying the hepato-bilio-pancreato-lienal zone.
6. Invasive methods of research of the hepato-bilio-pancreato-lienal zone.
7. What method allows the most accurate assessment of the functional state of the liver?
8. What method is the most informative for the study of the small intestine?

15. Irrigoscopy in the diagnosis of colitis and its varieties.
16. The role of general X-ray examination in the diagnosis of emergency conditions of the abdominal organs.
17. Endoscopic retrograde cholecystocholangiopancreat ography (ERCP).
18. X-ray examination and ultrasound in the diagnosis of diseases of the gallbladder and biliary tract.
19. Informativeness of methods of radiation diagnostics in liver diseases.
20. Ultrasound, CT and MRI in the diagnosis of diseases of the pancreas.

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9. What are the characteristic features of gastrointestinal tract diverticula?
10. What symptoms are typical for benign formation of the esophagus, stomach and intestines?
11. What is a “niche” symptom, what syndrome does it refer to?
12. Contraindications to the use of barium sulfate as a contrast agent.
13. What method is the most informative in urgent cases to determine ruptures of parenchymal organs?
14. What is a diaphragmatic hernia, what syndrome does it refer to?
1. Ultrasound symptoms of gallbladder calculi.
2. Ultrasound symptoms of cysts.
3. What evaluates the phase of "tight filling" of the stomach with a contrast agent during fluoroscopy?
4. What syndrome does the “index finger” symptom refer to?
5. What method is used to start the search for X-ray-positive foreign bodies in the gastrointestinal tract?
6. What technique is used for rapid contrasting of the small intestine?
7. What X-ray technique is used to study the relief of the folds of the esophageal mucosa?
8. What radiation method is used to study the functional state of the colon?
9. What research is carried out to diagnose intestinal obstruction?



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10. Radiation signs of intestinal obstruction.
11. What symptom is typical for perforation of a hollow organ in a general view of the abdominal cavity?
12. What is esophageal achalasia, what syndrome is typical for it?
13. What syndrome is typical for esophageal spasm?
14. What X-ray symptom is the main one in gastric ulcer?
15. Which method is the most informative for the diagnosis of volumetric liver lesions?
16. What methods of radiation research study the structure of the parenchymal organs of the abdominal cavity?
17. For what type of cholangiography is a fibro scope needed?
18. What parameters are assessed in X-ray diagnostics of functional disorders of the colon?
19. What is an irrigoscopy?
20. What X-ray symptom is leading in esophageal atresia?
21. What radiation method for studying the bile ducts does not require contrasting?

Module 8: RD of the urogenital system

Theme: Radiation diagnostics of the urinary system.

1. Kidneys. Radiation research in nephrology and urology - techniques, radiation anatomy and physiology of the urinary organs. Plain radiography, intravenous urography, retrograde pyelography, cystography, renal angiography, CT, MRI, radionuclide examination,

1. Make a table that reflects the radiation semiotics of diseases of the urinary system according to the following pattern:
"How each pathological nosology is displayed (for example, renal ICD) through":
1. Survey R-graphy - Shadows of calculi in any parts of the urinary tract
2. Contrast research methods - search field (cups, pelvis, ureter, bladder)

1. Atlas of Ultrasonography in Urology, Andrology and Nephrology. Editors Pasquale Martino and Andrea B. Galosi. © Springer International Publishing Switzerland. 2017.
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ultrasound. Indications and contraindications for the study. Principles of preparing a patient for research. Normal X-ray anatomy of the kidneys. X-ray diagnosis of abnormalities in the development of the kidneys.

2. The main radiation syndromes of kidney damage:

- mineral inclusion syndrome
- kidney dislocation syndrome
- syndrome of changes in the volume of the kidney
- deformity syndrome of PCS
- syndrome of lesions of the ureters and bladder.

3. The main radiation syndromes of kidney damage (nephritis, chronic pyelonephritis, abscess, hydronephrosis, kidney stones, tumors, cysts, trauma). Tactics of radiation examination for renal colic, gross hematuria, hypertension of renal origin.

4. Ultrasound syndromes in pathology of the urinary system:

5. Syndrome of anomalies of the kidneys and upper urinary tract. Atypical kidney syntopy (both an anomaly in the position of the kidney, kidney fusion, and an anomaly in the relationship of the kidneys). Lumbar, iliac, pelvic dystopia; horseshoe, L-, S- and I-shaped kidneys and nephroptosis. Unimaged kidney.

6. Syndrome of anomalies of the structure of the kidney parenchyma. Diffuse cyst and nephrosclerosis. Polycystic kidney disease. Juvenile polycystic disease. Unilateral multisystem. Spongy kidney.

3. Computed tomography of the Shadow of calculus

4. Ultrasound - Hyperechoic structure of the pelvic system of the urinary tract

5. Radionuclide research methods in any parts of the urinary tract, expansion of the PCS

6. Urography: a defect in filling the urinary tract with clear contours, dilation of the cup-tract, giving an acoustic Renography: obstructive curve type on the side of the affected kidney.

3. Genitourinary Radiology. Sixth Edition
Editors: N. Reed Dunnick, MD., Jeffrey H. Newhouse, MD., Richard h. Cohan, MD., Katherine E. Maturen, MD, MS. © 2018 Wolter Kluwer Philadelphia, Baltimor, New York, London, Buenos Aires, Hong Kong, Sydney, Tokyo.

4. Atlas of Ultrasonography in Urology, Andrology and Nephrology. Editors Pasquale Martino and Andrea B. Galosi. © Springer International Publishing Switzerland 2017

Additional references:

- Атлас диагностических изображений (300 снимков по 8-ми системам). Пособие для студентов лечебного факультета. Г. Гродно 2013. ГрГМУ доц. кафедры лучевой диагностики и лучевой терапии, к.м.н. В.Н. Волков
- Crack the Core Exam Copyright © 2015 by Prometheus Lionhart. All rights reserved - Under International and Pan-American Copyright Conventions. Title ID: 5260855 ISBN-13: 978-1507810859 Cover design, texts, and illustrations: copyright © 2015 by Prometheus Lionhart



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7. Syndrome of isolated fluid formation of the kidney. Simple cyst, parasitic cyst, abscess and tuberculous cavity.
 8. Syndrome of the volumetric formation of the kidney. Volumetric education with signs of good quality. Angiomyolipoma. Massive formation with signs of malignancy. Dilatation syndrome of the upper urinary tract. Echographically (calicoectasia), pelvis (pyeloectasia), ureter (ureteroectasia), normally not visualized.
 9. Hydro nephrotic syndrome.
 10. Syndrome of the volumetric formation of the prostate. Benign hyperplasia - prostate adenoma and prostate cancer.
 11. Syndrome of pathological contents of the bladder.
 12. Syndrome of damage to the bladder wall.

Questions for module 8:

1. Radioanatomy of the urinary system.
2. The role of tomographic techniques in the diagnosis of pyelonephritis and glomerulonephritis.
3. Diagnostics of hydronephrotic transformation of the renal pyelocaliceal system. The role of ultrasound in the diagnosis of hydronephrosis. A step-by-step explanation of this technique.
4. Urolithiasis. Sonographic diagnostics and urographic contrasting.
5. Rupture of the bladder walls and the role of CT and contrast

3. Review of Radiology
 7th Edition 2016. Sumer
 K. Sethi PeePee
 Publishers & distributors
 (P)LT



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enhancement in the diagnosis of this pathology.

6. Subcapsular hematomas of the kidneys. Ultrasound examination. The importance of traumatic factors in the development of uremia and hematuria.

7. Urographic data in the early diagnosis of renal tuberculosis and cancer.

8. Acute and chronic cystitis. Ultrasound-resulting diagnostics.

9. Renal colic. Etiopathogenesis. The role of diagnostic methods in the timely diagnosis and treatment of this pathology.

10. Ultrasound and Doppler study of the prostate.

11. Imaging symptoms of prostatitis and prostate adenoma.

12. Differentiation of visual diagnostic data.

13. Cancer of the prostate. Diagnostic criteria for ultrasound and Doppler. The value of determining PSA. Fine needle biopsy.

14. Renal hypertension. Possible causes and radiological signs.

15. Diagnostic capabilities of ultrasound, excretory urography, pyelography, CT, MRI in the study of the kidneys and urinary tract.

16. What contrast agents are used for excretory urography?

17. What parameters are determined by ultrasound examination of the kidneys?

18. Radiation methods of research in renal colic.



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19. Diagnostic capabilities of kidney scintigraphy.
20. Contraindications for CT and MRI of the urinary system.
21. Contraindications to pyelography.
22. Radiation symptoms of stones in the urinary system.
23. Radiation symptoms of urinary tract obstruction.
24. Radiation symptoms of masses in the urinary tract.
25. Radiation methods for the determination of nephroptosis.
26. Methods of research of the calyx-pelvic system.
27. What determines the Doppler ultrasound of the kidneys?
28. Interventional techniques used to treat the urinary system.
29. Anomalies in the development of the urinary system: anomalies of location, quantity, shape, development (aplasia, hypoplasia).

Unit 3, 8th semester

Practical lesson number 1.

Theme:

Indications and contraindications for radiation therapy. Physicotechnical and organizational foundations of radiation therapy. Clinical topometry and simulation.

Lesson # 1 questions

1. - Indications for radiation therapy
2. - Absolute and relative contraindications to radiation therapy.
3. Types of radiation therapy planning.
4. - Radical radiation therapy.
5. - Palliative radiation therapy.

1. Ionizing radiation and non – ionizing radiation.
2. Radiobiology effects of absorbed dose radiation.
3. Methods of radiation therapy.
4. External beam radiation therapy advantages.
5. Interstitial brachytherapy.
6. Types of treatment planning system.
7. Side effects of radiation therapy

1. National Cancer Institute (NCI) – [www.cancer.gov/clinical trials](http://www.cancer.gov/clinical_trials); clinical trials home page
2. The Official Internet site «Radiologyeducation.com» - Curated by Michael P.D'Alessandro, MD. etc
3. RadiologyEducation: <https://www.radiologyeducation.com/>
4. PubMed: <https://www.ncbi.nlm.nih.gov/>
5. MedLine: <https://www.nlm.nih.gov/>



6. -Symptomatic radiation therapy.
7. Physicotechnical and organizational foundations of radiation therapy.
8. - Immobilization and positioning of the patient during radiation therapy.
9. - Pre-radiation preparation of the patient. Planning and contouring of tumor boundaries and organs at risk of injury.
10. Clinical topometry and simulation.

Practical lesson No. 2. Topic: Clinical radiobiology. Clinical dosimetry. Fractional treatment modes.

Lesson # 2 questions:

1. - Biological bases of radiation therapy: sublethal and lethal radiation injuries;
2. -Radiosensitivity of tumors and healthy tissues, radiosensitivity at different periods of the cell cycle, oxygen effect.
3. The concept of absorbed dose and fraction.
4. - Modes of fractionation of a dose of ionizing radiation. Hyperfraction, hypofraction and standard fraction modes.
5. -Radiomodification, its types.

Practical lesson number 3.

Topic: External beam therapy. Brachytherapy.

Lesson 3 questions

1. External beam therapy.
2. -Radiation therapy equipment.
3. -Methods of the planning system; IMRT, IGRT, CBRT, Cyber Knife,

6. Medscape:
<https://www.medscape.com/>
7. Radiopaedia:
<https://radiopaedia.org/>
8. Hansen E.K., Roach M.K., “Handbook of Evidence –Based Radiation Oncology” (2014).
9. Barret A.,Dobbs J., Practical Radiotherapy Planning.,Hachette UK Company 2009.
10. Khan FM (2003) The physics of radiation therapy, third edn. Lippincott, Williams and Wilkins, Philadelphia.
11. Hall EJ (2000) Radiobiology for the radiologist, fifth edn. Lippincot, Williams and Wilkins, Philadelphia.
12. Hanna L. Crosby T. Practical Clinical Oncology Cambridge University Press. Medicine. 2008.
13. Steel GG (ed) (2002) Basic Clinical Radiobiology, 3rd edn. Hodder Arnold, London.
14. L.W Brady., H.P Heilmann., New Technologies in Radiation Oncology Philadelphia. Springer. 2006.
15. Thomadsen B. Achieving Quality in Brachytherapy. London: ylor & Francis, 1999.



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4. SRS, stereotactic surgery.
5. The concept of brachytherapy. Dose distribution for brachytherapy
6. -Types of brachytherapy; application, interstitial, intraluminal and intracavitary radiation therapy.
7. -System brachytherapy.
8. -Pre-radiation preparation of the patient.
9. -Physical and technical equipment of brachytherapy.
10. - Dose distribution of radiation in brachytherapy.

Practical lesson number 4

Topic: Radiation reactions and injuries.

Lesson # 4 questions

-Management of radiation reactions of normal and tumor tissues.

-The concept of early and late complications in different age categories. Prevention of radiation injuries.

-The concept of general and local, acute and chronic complications. Radiation-induced cancer.

Questions of the course Radiotherapy

1. Goals and objectives of radiation therapy.
2. Types of ionizing radiation.
3. Interaction of ionizing radiation with matter.
4. Radiosensitivity at different periods of the cell cycle.
5. Oxygen effect.
6. Modes of fractionation of the dose of ionizing radiation.
7. Types of radio modification.
8. Pre-radiation preparation of the patient.
9. External beam therapy.



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<p>10. Types of brachytherapy. 11. Early and late complications of radiation therapy, their prevention. 12. General and local complications. 13. Acute and chronic complications. 14. Control of radiation reactions.</p>			
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1.4. Control questions for the course:

Current and midterm (modular) control

Unit 1 True / False questions:

- ✓ Radio waves are passing through bodies. True
- ✓ X-rays have the shortest wavelength. False
- ✓ Beta particles are high energy, large subatomic structure of protons and neutrons. False
- ✓ Beta particles are fast moving electrons. True
- ✓ Alpha particles can travel only a short distance and are stopped by skin. True
- ✓ Electromagnetic waves are produced by a vibrating electric charge. True
- ✓ Particulate radiation is produced by a vibrating electric charge. False
- ✓ Particulate radiation is produced by disintegration of unstable atoms. True
- ✓ All the types of electromagnetic radiation are the stream of particles. False
- ✓ Particulate radiation doesn't have weight. False
- ✓ Microwaves and radio waves are pure energy with no mass. True
- ✓ Alpha radiation differs from beta radiation in their wavelengths. False
- ✓ Gamma radiation is the most penetrating among electromagnetic radiation. True
- ✓ Each type of electromagnetic radiation has different effect on matter. True
- ✓ X-rays are produced by disintegration of radioactive materials. False
- ✓ Beta particles are more penetrating than gamma rays. False

Module #1 CVS (Cardiovascular system)

	What is the main method of radiation diagnostics in the study of the heart and blood vessels.
	What is the general roentgenosemiotics of heart and vascular disease (draw changes in the configuration of the heart and the state of the pulmonary pattern, and give them an explanation).
	Which method is objective when studying the contractile function of the heart segments?
	What method is the most informative in the study and diagnosis of congenital heart defects.
	What method of radiation diagnostics can detect defects of the interventricular and interatrial septa.



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	What methods are used, in addition to radiation, to determine defects of the interventricular and interatrial septa.
	What is the most informative method for determining aneurysms of arteries and veins.
	Which method is the most informative for identifying adynamic zones of the ventricles, that is, areas with no contractions, which is characteristic of postinfarction cardiosclerosis.

Module #2 Respiratory system

Current questions of the module #2:

1. Stages of x-ray analysis of the chest organs.
2. The sequence of characteristics of the selected radiographic symptom of pathology.
3. What pathological processes in the lung tissue, pleural cavity can cause syndromes of total, subtotal blackout, limited blackout?
4. On what signs is the differential diagnosis of total, subtotal and limited obscuration based?
5. What are the radiological signs of a decrease in lung volume?
6. X-ray picture of the syndrome of total, subtotal, limited blackout in pneumonia, atelectasis, exudative pleurisy.
7. What pathological processes in the lung tissue and what diseases cause syndromes of focal shadow, limited and widespread dissemination, round and annular shadow?
8. On what X-ray morphological and clinical signs is the differential diagnosis of these syndromes based?
9. X-ray picture of focal shadow syndrome, limited and widespread dissemination.
10. X-ray picture of the syndrome of a round and annular shadow.
11. X-ray picture of the syndrome of extensive enlightenment.
12. Name the main differential diagnostic sign of pneumothorax, chronic vesicular emphysema.
13. What types of pneumothorax do you know due to the origin and development mechanism?
14. X-ray picture in root pathology syndrome.
15. Violation of bronchial patency. Development phases and X-ray picture.
16. How does the development of symptoms of impaired bronchial patency depend on tumor growth?
17. In what diseases is there a bilateral root lesion?
18. What lung diseases can be associated with root pathology syndrome?

Module #3 Reproductive system

Current questions of the module #3:

11. Radiation methods for studying the organs of the endocrine system in children and adults.
12. Radiation anatomy of the thyroid gland, pituitary gland, parathyroid glands, thymus, adrenal glands.
13. Indications for conducting radiation studies of the endocrine glands.



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14. X-ray research methods: determination of bone age, Turkish saddle with pituitary adenomas, osteoporosis with hypercortisolism, diabetes mellitus.
15. Radioisotope imaging of the endocrine glands in the syndrome of hyperthyroidism and the syndrome of hypothyroidism. Test of absorption of ^{99}Tc - pertechnetate, ^{131}I -iodine, ^{123}I -iodine.
16. Methods of visualization of the adrenal glands in the syndrome of insufficiency of the adrenal cortex: sonography, CT, scintigraphy with ^{131}I iodine-cholesterol.
17. Radiation examination of the pituitary gland in the syndrome of insufficiency of the pituitary gland. Diagnosis of pituitary adenoma using MRI, CT, skull X-ray.
18. Radioimmunological analysis of the content of hormones in the blood.
19. Radiation symptoms of pancreatic pathology.
20. Identification of clinical and radiation syndromes.

Module #4 Endocrinology system

Current questions to the module #4:

1. What radiation methods are used to study the mammary glands, their capabilities and limitations.
2. Specify the optimal days of the menstrual cycle for diagnostic mammography.
3. Radiation symptoms of benign and malignant formations in the mammary gland during mammography.
4. Radiation symptoms of benign and malignant formations in the mammary gland by ultrasound.
5. Radiation symptoms of benign and malignant formations in the mammary gland during magnetic resonance mammography.
6. Which method is the most informative for examining the pelvic organs - CT or MRI? Explain why.
7. What method of radiological diagnosis is used to control the biopsy of the prostate gland?
8. The term for the appearance of the ovum, its ultrasound picture.
9. The timing of the appearance of structures and organs of the fetus.
10. Basic parameters of fetal ultrasound biometrics.
11. Tasks of ultrasound in the first trimester of pregnancy.
12. Tasks of ultrasound in the II trimester of pregnancy.
13. Tasks of ultrasound in the II-I trimester of pregnancy.
14. What is the use of Doppler ultrasonography of a pregnant woman?
15. What radiation methods are used to study the uterus and appendages, their capabilities and limitations.
16. What radiation methods are used to study the reproductive system of men, their capabilities and limitations.
17. Features of the use of radiation methods for the study of the reproductive system of children.
18. Metrosalpingography technique, indications and contraindications, normal radiation pattern.

Module #5 Nervous system

Current questions to the module #5:

1. Indications for radiation examination of the brain.
2. Advantages and limitations of CT in examining the brain and spinal cord.



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3. Advantages and limitations of the MRI method for examining the brain and spinal cord.
4. Varieties of magnetic resonance imaging methods used to study the brain and spinal cord.
5. Possibilities of the ultrasound method in determining the pathology of the brain in children.
6. Possibilities and limitations of radiography in the study of the brain and spinal cord.
7. Signs of hypertensive syndrome on ultrasound, CT, MRI.
8. Indirect signs of compression of intervertebral discs on radiographs.
9. The difference between protrusion of an intervertebral disc from a herniated disc.
10. Radiation symptoms of subdural, epidural hematomas and subarachnoid hemorrhages.

Module #6 Musculoskeletal system

Current questions to the module #6:

1. What kind of methods of radio diagnosis apply in skeleton diseases?
2. Indicate the age of appearance focus of bone and age of synostosis?
3. How many bones has adult person?
4. What kind of tubular bones' parts we can see on the x-ray films?
5. Body of tubular bone is
6. In what form emerges joint {cartilage} space on radiogram?
7. What is the difference on the X-ray image of flat bone from the image of long bone?
8. What methods are most effective for researching muscles and soft tissues, ligamentous apparatus?
9. What does it mean "hyperostosis", and its causes? Atrophy and its causes? Osteophyte and its causes?
10. Whether can we see periosteum in the theory on radiograph?
11. What kinds of periostitis do you know?
12. What types of bones' structural changing mainly do you know in case of fractures?
13. What kinds of osteoporosis do you know?
14. What are the x-ray signs of the gunshot wound?

Current questions to the module #7:

1. What research method is better for revealing folds of the esophageal mucosa?
2. A symptom of what syndrome is a rounded formation with a tuberos surface growing into the lumen of the colon?
3. How do the folds of the mucous membrane change with the symptom of filling defect of malignant genesis in the gastrointestinal tract?
4. How do the folds of the mucous membrane change with a symptom of a benign filling defect in the gastrointestinal tract?
5. Non-invasive radiation methods for studying the hepato-bilio-pancreato-lienal zone.
6. Invasive methods of research of the hepato-bilio-pancreato-lienal zone.
7. What method allows the most accurate assessment of the functional state of the liver?
8. What method is the most informative for the study of the small intestine?
9. What are the characteristic features of gastrointestinal tract diverticula?



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10. What symptoms are typical for benign formation of the esophagus, stomach and intestines?
11. What is a “niche” symptom, what syndrome does it refer to?
12. Contraindications to the use of barium sulfate as a contrast agent.
13. What method is the most informative in urgent cases for determining ruptures of parenchymal organs?
14. What is a diaphragmatic hernia, what syndrome does it refer to?
15. Ultrasound symptoms of gallbladder calculi.
16. Ultrasound symptoms of cysts.
17. What does the phase of "tight filling" of the stomach with a contrast agent evaluate during fluoroscopy?
18. What syndrome does the “index finger” symptom refer to?
19. What method is used to start the search for X-ray-positive foreign bodies in the gastrointestinal tract?
20. What technique is used for rapid contrasting of the small intestine?
21. What X-ray technique is used to study the relief of the folds of the esophageal mucosa?
22. What radiation method of research is used to study the functional state of the colon?
23. What research is carried out to diagnose intestinal obstruction?
24. Radiation signs of intestinal obstruction.
25. What symptom is typical for perforation of a hollow organ on a survey of the abdominal cavity?
26. What is esophageal achalasia, what syndrome is typical for it?
27. What syndrome is typical for esophageal spasm?
28. What X-ray symptom is the main one in gastric ulcer?
29. What is the most informative method for diagnosing volumetric liver lesions?
30. What methods of radiation research study the structure of the parenchymal organs of the abdominal cavity?
31. For what type of cholangiography is a fibro scope necessary?
32. What parameters are assessed in X-ray diagnostics of functional disorders of the colon?
33. What is irrigoscopy?
34. What X-ray symptom is leading in esophageal atresia?
35. What radiation method for studying the bile ducts does not require contrasting?

Module #8 Urinary system

Current questions to the module #8:

1. Diagnostic capabilities of ultrasound, excretory urography, pyelography, CT, MRI in the study of the kidneys and urinary tract.
2. What contrast agents are used for excretory urography?
3. What parameters are determined by ultrasound examination of the kidneys?
4. Radiation methods of research in renal colic.
5. Diagnostic capabilities of kidney scintigraphy.
6. Contraindications for CT and MRI of the urinary system.



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7. Contraindications to pyelography.
8. Radiation symptoms of stones of the urinary system.
9. Radiation symptoms of urinary tract obstruction.
10. Radiation symptoms of masses in the urinary tract.
11. Radiation methods for the determination of nephroptosis.
12. Methods of research of the calyx-pelvis system.
13. What determines the Doppler ultrasonography of the kidneys?
14. Interventional techniques used to treat the urinary system.
15. Anomalies in the development of the urinary system: anomalies of location, quantity, shape, development (aplasia, hypoplasia).

Current control of the discipline in the 3rd unit

Question options of the 3rd unit:

1. List the types of ionizing radiation used in radiation therapy.
2. Effects of ionizing radiation on the body
3. The concept of radioactivity.
4. Indications for radiotherapy of tumor neo-tumor diseases
5. Absolute and relative contraindications to radiotherapy.
6. The basic rule of radiation therapy.
7. The concept of the dose field
8. How is the cumulative dose administered in radiotherapy?
9. List the methods of radiation therapy.
10. The concept of radiosensitivity.
11. Fractional (fractional) irradiation
12. To give the concept of a fractional-extended method of summing up the total dose.
13. Define the interstitial radiotherapy method.
14. Name the advantages of the intracavitary irradiation method.
15. The main difference between intracavitary irradiation and interstitial.
16. The concept of distance exposure, exposure modes
17. List and give a brief description of remote methods of radiation therapy.
18. The concept of combined treatment.
19. Define the combined treatment method.
20. The basic principles of radiation therapy of malignant tumors.
21. Methods of radiation therapy, depending on the distribution of the dose of radiation over time.
22. Indications and objectives of pre- and postoperative radiotherapy.
23. Indications for use of interstitial and intracavitary gamma therapy.
24. Distribution of tumors by radiosensitivity.
25. Factors affecting the radiosensitivity of normal tissues and tumors.
26. What do we mean by radiosensibility of a tumor?
27. What are the main ways to protect normal tissue from radiation.



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28. "Oxygen effect" and methods of radio modification in which it is implemented.
29. What radiation causes the maximum dose in the surface layers?
30. What radiation causes the maximum ionization at a depth of 4-6 cm of the human body?
31. Methods of radiation therapy according to the method of summing up doses to the tumor.
32. What radiation causes the maximum dose of ionization at a depth of 0.3-0.5 cm of the human body?
33. What radiation causes the maximum ionization at a depth of 1-3 cm of the human body?
34. Brachytherapy indications
35. Late and early side effects damaging after radiation therapy. Prevention and treatment.

1.5. EDUCATIONAL – METHODOLOGICAL AND INFORMATIONAL SUPPORT OF THE DISCIPLINE

List of recommended literature:

- recommended textbooks, teaching aids and Internet resources:

a) Main references:

1. Radiobiology for the radiologists / Eric J. Hall, Amatto J/ Giaccia
2019 Wolters Kluwer (over 1000pages) Section I &... (watch content!)
2. Review of Radiology Sumer K.Sethi 7th edition 2016
 - a. Pages from 1t, 301,316
3. History of radiology/ Adrian M. K.Thomas/ OXFORD university press2013
4. Clinical atlas of human anatomy (interactive) Elsevier eight edition 2020 Abrahams' & MCMINN's
5. Atlas of thyroid ultrasonography. Springer 2017. Editors Milan Halenks & Zdenek Frysak
6. Emergency Radiology. (for NS) Second Edition by Jorge A. Soto, MD., Brain C. Lucey MD. Elsevier, 2017
7. Musculoskeletal imaging. Fourth edition. B.J.Manaster. David A. May & David G. Disler Mosby Elsevier Saunders. 2013
8. Atlas of Ultrasonography in Urology, Andrology and Nephrology. Editors Pasquale Martino and Andrea B. Galosi. © Springer International Publishing Switzerland. 2017.
9. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 1. The normal chest: methods of investigation and differential diagnosis Cтp.1-56



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10. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 2. The normal heart: anatomy and techniques of examination Стр. 265-282
 11. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 2. Acquired heart disease I: the chest radiograph. Стр. 283-316
 12. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 2. Acquired heart disease II: non-invasive imaging. Стр.317-346
 13. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 2. Invasive imaging and interventional techniques. Стр. 347-362
 14. David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003. Volume 2. Section 2. Arteriography and interventional angiography Стр. 411-482
 15. Clinical Atlas of Cardiac and Aortic CT and MRI. Springer 2019. Editors: Patricia M. Carrascosa, Carlos M. Capunay, Alejandro Deviggiano, Gaston A. Rodrigues-Granillo
 16. Case Companion Imaging anatomy: chest, abdomen, pelvis, second edition Copyright © 2017 by Elsevier Editors: Michael P. Federle, MD, FACR and colleagues....
 17. Clinical Sonography. A practical guide 5th edition © 2016 Wolter Kluwer Roger Sanders. Barbara Hall Terracciano
 18. CALLEN'S ULTRASONOGRAPHY IN OBSTETRICS AND GYNECOLOGY, SIXTH EDITION.1600 John F. Kennedy Blvd.Ste 1800 Philadelphia, © 2017 by Elsevier, Inc. All rights reserved.
- b) Additional references:*
1. Crack the Core Exam - First Ed. - Version 1.12015 by Prometheus Lionhart from the page #44 A–Z of Chest Radiology
 2. RadiologyEducation: <https://www.radiologyeducation.com/>
 3. PubMed: <https://www.ncbi.nlm.nih.gov/>
 4. MedLine: <https://www.nlm.nih.gov/>
 5. Medscape: <https://www.medscape.com/>
 6. Radiopaedia: <https://radiopaedia.org/>
 7. ©Атлас диагностических изображений (300 снимков по 8-ми системам). Пособие для студентов лечебного факультета. Г.Гродно 2013. ГрГМУ доц. кафедры лучевой диагностики и лучевой терапии, к.м.н. В.Н. Волков



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2. Hansen E.K., Roach M.K., “Handbook of Evidence –Based Radiation Oncology” (2014).
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