INTERNATIONAL HIGHER SCHOOL OF MEDICINE

Department of Cardiac Surgery and Radiology

SYLLABUS
Emergency Radiology

2025-2026 academic year
for students of medical faculty
5th course 10th semester, groups 5, 7, 17 (according to the timetable)
2 credits (60 h, including auditorial 24 h, independent work – 28 h)

Lecturer: **Oksana Skorobogatova**
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Venue: Vedanta University Clinic, 34, Fuchic st., 6th floor
Zoom Conference
https://zoom.us/j/95014802697?pwd=oI7za4KtK4JlP9hEbtnJ5yr5hC4jAg.1

Идентификатор конференции: 950 1480 2697
Код доступа: 713407

Practical classes: **Oksana Skorobogatova**

Venue: Vedanta University Clinic, 34, Fuchic st., 6th floor, room 610

The Syllabus is considered
at the meeting of the Department of Cardiac Surgery and Radiology

Protocol № 2 dated 01.09.2025
Head of the department _____I.H. Bebezov

Course Objective: Emergency radiology consists of the study of radiological features of various pathological conditions in emergency settings using diagnostic imaging techniques for their adequate use in diagnosis and treatment.

After study of the discipline the student must:

Knowledge:

- the types and properties of the radiation used in radiology;
- methods of protection from ionizing radiation;
- principles of acquiring images with different methods of diagnostic imaging;
- criteria for evaluation of different anatomical regions and particular organs under different methods of diagnostic imaging;
- terminology used for the analysis of X-ray, CT, MRI, ultrasound, radionuclide images;
- diagnostic possibilities and limitations of each method of diagnosis imaging;
- interventional procedures in emergency settings;
- radiological methods for diagnosing emergency and life-threatening conditions of various body systems and anatomical areas**.**

Skill:

- to recognize the basic anatomical structures on X-rays, CT, MRI, US images, scintigrams;
- to recognize the radiological signs of traumatic and non-traumatic injuries of head and trunk;
- to recognize the radiological signs of traumatic and non-traumatic injuries of upper and lower extremities;
- to recognize the radiological signs of traumatic and non-traumatic injuries of the abdomen and pelvis;
- to recognize the radiological signs of cardiovascular emergencies.

Attitude:

- identify the indications and contraindications for each diagnostic imaging method
- ability to correctly and effectively use standard radiological diagnostic algorithms to make a diagnosis of life-threatening conditions.

Pre-requisites. To study this academic discipline requires knowledge, skills and abilities, formed by previous disciplines: Normal Anatomy, Normal Physiology, Pathological anatomy, Pathophysiology, Medical physics and higher mathematics, Biochemistry, Latin language, Radiology, Surgery, Traumatology, Orthopedics, Obstetrics and gynecology, Urology.
Post-requisites. As a result of studying this section, the foundation is laid for further study by students of the following clinical disciplines: Anesthesiology and intensive care, Family medicine, Cardiac surgery.

THEMATIC PLAN OF LECTURES

№	Unit	Theme of lecture	Hours	Date
1	Imaging of traumatic emergencies.	Л1: Radiology overview.	2	25.08.2025-03.01.2026
		Л2: Traumatic injuries of head and trunk.	2	25.08.2025-03.01.2026
		Л3: Traumatic injuries of upper and lower extremities.	2	25.08.2025-03.01.2026
2	Imaging of non-traumatic emergencies.	Л4: Emergency radiology of nervous system.	2	25.08.2025-03.01.2026
		Л5: Emergency radiology of respiratory system.	2	25.08.2025-03.01.2026
		Л6: Emergency radiology of cardiovascular system.	2	25.08.2025-03.01.2026
Всего			**12**	

THEMATIC PLAN OF PRACTICAL CLASSES

№	Unit	Theme of practical class	Hours	Date
1	Imaging of traumatic emergencies.	1. Introduction to Emergency Radiology.	2	25.08.2025-03.01.2026
		2. Imaging in trauma to the head and trunk.	2	25.08.2025-03.01.2026

		3. Imaging in trauma to the upper and lower limbs.	2	25.08.2025-03.01.2026
		4. Imaging in trauma to the abdomen and pelvis.	2	25.08.2025-03.01.2026
		5. Unit 1 control		25.08.2025-03.01.2026
2	Imaging of non-traumatic emergencies.	1. Imaging of non-traumatic emergencies of head and thorax.	2	25.08.2025-03.01.2026
		2. Imaging of non-traumatic emergencies of the abdomen and pelvis.	2	25.08.2025-03.01.2026
		3. Imaging in cardiovascular emergencies.	2	25.08.2025-03.01.2026
		4. Interventional radiology in emergency setting.	2	25.08.2025-03.01.2026
		5. Unit 2 control	2	25.08.2025-03.01.2026
Total			**20 hours**	

THEMATIC PLAN OF INDEPENDENT WORK OF STUDENTS

№		**Theme of independent work**	**Hours**	**Date**
1	Unit 1 Imaging of traumatic emergencies.	Study of the results of radiological methods. Situational tasks. Abstracts and presentations on specific topics.	14	25.08.2025-03.01.2026
2	Unit 2 Imaging of non-traumatic emergencies.	Study of the results of radiological methods. Situational tasks. Abstracts and presentations on specific topics.	14	25.08.2025-03.01.2026

Recommended reading for the discipline:

Basic

1. Editor: Robert F. Dondelinger. Help. Emergency. 2017. European Society of Radiology (ESR)ISBN: 978-3-9504388-4-0
2. Harris JH, Harris WH, The Radiology of Emergency Medicine. Williams &Wilkins, Baltimore, MD, Fourth Edition, 2000.

Additional

1. E. Scott Pretorius, Jeffrey A. Solomon. Radiology Secrets Plus (Third Edition). 2011. Elsevier
2. Jerry L. Prince, Jonathan M. Links. Medical Imaging Signals and Systems. 2nd edition. 2015. Elsevier saunders
3. David Sutton. Textbook of radiology and imaging. 7th edition. 2003. Churchill Livingstone.

Resources of the information and telecommunication network "Internet"

1. Electronic library of the Department of Cardiac Surgery and Radiology of the International Higher School of Medicine/
2. https://www.radiologyeducation.com/
3. https://radiopaedia.org/
4. http://www.learningradiology.com/
5. https://www.radiologymasterclass.co.uk/

Grading policy and procedures for all types of work

For the period of studying the discipline, the student gains points for the relevant parameters (per unit):
current score - 40 points
independent work - 20 points
control score (final assessment of knowledge per unit) - 40 points
Maximum score - 100 (40+20+40)

Grading system for student's achievements

Grading criteria per discipline				
Maximum score	Intervals			
	«unsatisfactory»	«satisfactory»	«good»	«excellent»
Current control- 40	0-23	24-30	31-35	36-40
Interval description	Not ready for class	Passive, does not participate in the discussion of the lesson topic	Actively participates in the discussion of the lesson topic, occasionally gets confused about the details.	Actively participates in the discussion of the lesson topic, gives a complete and accurate answer to the question.
Independent work - 20	0-11	12-15	16-17	18-20
Interval description	Does not answer questions on the topic	Has difficulty answering, has poor knowledge of the subject	Responds well, but occasionally gets confused in some answers.	Confident, complete answer. Shows good knowledge of the subject, does not get confused in their answers.
Control work (module) – 40	0-23	24-30	31-35	36-40
Interval description	Does not respond to questions	Has difficulty answering, does not know the answer well	Responds well, occasionally gets confused in some answers	Answers all questions correctly and completely. Does not get confused in their answers.

Conduct Policy: (lateness, absence, behavior in the auditorium, late submission of work).
- Punctuality and completion of tasks.
- Mandatory attendance of classes.
- Attending class in a clean medical uniform.
- Eliminating conversations on a cell phone in the classroom.
- Active participation in the learning process.
- Submission of assignments on time.

For violations of the Conduct Policy, the total points for discipline might be reduced to 1-10 points.

Academic Ethics Policy.
- Be tolerant, respect the opinions of others.
- Formulate objections in the correct form.
- Constructively support feedback in all classes.
- Plagiarism and other forms of dishonest work are unacceptable. Plagiarism includes the following: the absence of references when using printed and electronic materials, quotes, thoughts and works of other authors or students.
- Prompting and cheating during tests, exams, classes is unacceptable as well as passing an exam for another student, unauthorized copying of materials.

For violations of the Academic Ethics Policy, the total points for the discipline may be reduced to 1-10 points.

GUIDELINES FOR THE LESSONS OF THE DISCIPLINE

Unit 1: Imaging of traumatic emergencies.

Key questions covered in lesson 1. Introduction to Emergency Radiology.

Radiation types: electromagnetic and particulate, ionizing and non-ionizing, natural and artificial radiation. Properties of different radiation types. Biological effect of ionizing radiation. Stochastic and deterministic effects. Methods of protection from ionizing radiation. Radiation doses.

The history of radiation studying, discovering of the X-rays, radioactivity, CT-scanning, MRI and ultrasound.

Recommended reading for the lesson:

1)Michael Y. M. Chen, Thomas L. Pope, David J. Ott – Basic Radiology, 2nd ed., 2004.

Key questions covered in lesson 2. Imaging in trauma to the head and trunk.

Types of **Skull fractures**. Extra-axial hemorrhages: subdural, epidural hematomas.

Parenchymal injuries: cortical contusion, diffuse axonal injury, deep gray matter injury, brainstem injury. Subarachnoid hemorrhage.Vascular injuries.Penetrating injuries.

Spinal trauma: spinal cord contusion, spinal epidural hematoma, nerve root avulsion. Mechanism of injury, radiographic patterns, normal variants, frequently associated injuries.
1. Cranio-cervical / C1-C2: occipital condyle fracture, atlanto-occipital dislocation / subluxation, Jefferson burst fracture, atlanto-axial rotary fixation,c1 – posterior arch, dens fracture, Hangman's fracture
2. C3-T1: anterior subluxation / whiplash syndromes, hyperextension sprain / spinal cord injury without radiographic abnormalities, wedge compression, spinous process fractures, burst compression, flexion tear drop fracture, bilateral facet dislocation, unilateral facet dislocation, articular mass and transverse process fractures, traumatic isolation of articular pillar / pedicolumnar separation, Corner avulsion fracture (extension teardrop), laminar fractures, facet dislocation with fracture, acute ligamentous injuries.
3. Thoraco-lumbar spine trauma: compression fracture, burst fracture, chance fracture, complex fracture-dislocation
4. Traumatic injuries to intervertebral disks.

Chest trauma

a. Rib fractures
b. Sternal and manubrial fractures
c. Hemothorax
d. Pneumothorax and pneumomediastinum
e. Mediastinal hemorrhage
f. Pulmonary contusion, laceration, hematoma (Case 1) (Case 2) (Case 3)
g. Tracheobronchial injury
h. Esophageal tear
i. Diaphragm injury

Abdominal Trauma

a. Hemoperitoneum and intraperitoneal fluid
b. Hemodynamic status assessment
c. Retroperitoneal hemorrhage
d. Gas collections: intraperitoneal and retroperitoneal
e. Active arterial extravasation on CT
f. Splenic injuries
g. Liver injuries
h. Gallbladder and biliary injuries
i. Bowel injuries
j. Mesenteric injuries
k. Pancreatic injuries
l. Renal injuries
m. Bladder injuries: intraperitoneal and extraperitoneal
o. Abdominal wall injuries and diaphragmatic hernias

Recommended reading for the lesson:
1) E. Scott Pretorius, Jeffrey A. Solomon-Radiology Secrets Plus (Third Edition), 2011.
2) https://radiologykey.com/tag/manual-of-head-and-neck-imaging/
3) https://radiologykey.com/abdominal-pain-abdominal-trauma/

Key questions covered in lesson 3. Imaging in trauma to the upper and lower limbs.

Upper limbs:
1. Scapulothoracic dissociation
2. Clavicle fractures and dislocations**: sternoclavicular, acromioclavicular.**
3. Glenohumeral dislocations
4. Scapular fractures
5. Humerus fractures
6. Elbow dislocations
7. Forearm fractures & dislocations**:** Fractures: ,coronoid process, Radial tubercle, Distal radius (Colles, Smith, Barton types, Die-punch fracture radiolunate fossa). Defensive injuries to ulna, including classic nightstick. Single bone fracture with associated dislocation non fractured bone (Monteggia, Galeazzi, Essex-Lopresti). Dislocations.
8. Carpal bone fractures
9. Carpal dislocations and malalignments
10. Metacarpal fractures
11. Phalangeal fractures

Lower limbs:
1. Femoral shaft fractures
2. Patella fractures
3. Tibial plateau fractures
4. Tibial spine avulsion fractures
5. Cruciate and other ligamentous injuries of the knee

6. Meniscus tears
7. Knee dislocations
8. Tibial stress fractures
9. Tibial and fibular shaft fractures
10. Tibial plafond fracture (pilon fractures)
11. Ankle mortise injury
12. Calcaneal fractures
13. Achilles tendon and ligamentous injuries of the ankle
14. Talus fractures
15. Talar and subtalar dislocations
16. Tarsal fractures
17. Tarso-metatarsal fracture dislocations (Lisfrancís fracture)
18. Metatarsal fractures
19. Toe fractures
20. Septic arthritis
21. Muscle injuries
22. Compartment syndrome
23. Diabetic muscle infarction
24. Diabetic foot infections

Recommended reading for the lesson:
1) Harris JH, Harris WH, The Radiology of Emergency Medicine. Williams & Wilkins, Baltimore, MD, Fourth Edition, 2000.
2) David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003.
3) https://radiologykey.com/injuries-of-the-limbs-in-polytrauma-upper-and-lower-limbs/

Key questions covered in lesson 4. Imaging in trauma to the abdomen and pelvis.

1. **Abdominal Trauma**
   a. Hemoperitoneum and intraperitoneal fluid
   b. Hemodynamic status assessment
   c. Retroperitoneal hemorrhage
   d. Gas collections: intraperitoneal and retroperitoneal
   e. Active arterial extravasation on CT
   f. Splenic injuries
   g. Liver injuries
   h. Gallbladder and biliary injuries
   i. Bowel injuries
   j. Mesenteric injuries
   k. Pancreatic injuries
   l. Renal injuries
   m. Bladder injuries: intraperitoneal and extraperitoneal
   o. Abdominal wall injuries and diaphragmatic hernias
2. Injuries depend upon patient composition, blunt versus penetrating injury, mechanism of injury, and strength of forces.
3. Blunt trauma etiologies: motor vehicle crash, falls, assault, and sports resulting in deceleration/shear forces, crushing forces, and increased intraabdominal pressure.
4. Major cause of preventable death is intraabdominal hemorrhage.\
5. Advantages and limitations of technics

Recommended reading:
1)Fred A. Mettler Jr., M.D., M.P.H.- Essentials of Radiology**,** 2nd ed., 2005
2)David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003
3) https://radiologykey.com/abdominalpelvic-trauma/

Key questions covered in lesson 5. 1st unit control
Student presentations, testing, solving situational problems using the imaging studies (X-ray, CT, MRI and ultrasound images).

Unit 2: Imaging of non-traumatic emergencies.
Key questions covered in lesson 1. Imaging of non-traumatic emergencies of head and thorax.
Head
1. Cerebral infarction (arterial, venous infarction; diffusion and perfusion imaging appearance)

2. Non-traumatic hemorrhage (subarachnoid and parenchymal hemorrhage)
3. Central nervous system infections (meningitis, encephalitis, abscess/cerebritis, subdural empyema, spinal epidural abscess, osteomyelitis/discitis)
4. Dural sinus thrombosis
5. Reversible posterior leukoencephalopathy syndrome
6. Pituitary apoplexy

Thorax

1.Pulmonary embolism
2. Acute pulmonary infections
3. Aspiration pneumonia
4. Airway foreign bodies
5. Obstructive airway disease
6. ARDS: near-drowning, fat embolism syndrome
7. Esophageal rupture

Recommended reading:
1)Fred A. Mettler Jr., M.D., M.P.H.- Essentials of Radiology**,** 2nd ed., 2005
2)David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003.

Key questions covered in lesson 2. Imaging of non-traumatic emergencies of the abdomen and pelvis.

Abdominal Emergencies

a. The peritoneal cavity (ascites, peritonitis, abdominal abscess)
b. Liver and biliary tract (jaundice: obstructive and non-obstructive, cholecystitis)
c. Pancreatitis
d. Urinary tract (urinary stones, infection, pyelonephritis, renal abscess)
e. Adrenal hemorrhage
f. Gastrointestinal tract (gastrointestinal hemorrhage, bowel obstruction, bowel infarction, bowel infection, appendicitis, diverticulitis, infectious enteritis and colitis)
g. Epiploic appendagitis
h. Inflammatory bowel disease (Crohn disease, ulcerative colitis)

Pelvic Emergencies

Female: ectopic pregnancy, acute pelvic inflammatory disease, miscarriages and complicated ovarian cysts, menstrual disorders, abnormal vaginal bleeding, complications of unsafe abortion.
Male: Urethral foreign bodies, Urethral stones. Acute non-traumatic scrotal conditions:

a. Testicular torsion
b. Epididymitis
c. Orchitis
d. Acute fluid collections (Hydrocele, hematocele, pyocele)
e. Epididymoorchitis
f. Infarction
g. Abcess
h. Fornierís Gangre

Recommended reading for the lesson:
1)Fred A. Mettler Jr., M.D., M.P.H.- Essentials of Radiology**,** 2nd ed., 2005
2)David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003.

Key questions covered in lesson 3. Imaging in cardiovascular emergencies.

1. Myocardium and Pericardium
   a. Myocardial infarction
   b. Myocardial laceration
   c. Myocardial contusion
   d. Pericardial effusion – tamponade
   e. Pneumopericardium – tamponade
2. Aorta
   a. Aortic trauma
   b. Aortic dissection
   c. Aortic aneurysm
3. Pulmonary Edema – various etiologies
4. Thrombo-embolic disease
   a. Deep venous thrombosis
   b. Pulmonary embolism

Recommended reading for the lesson:
1)Fred A. Mettler Jr., M.D., M.P.H.- Essentials of Radiology**,** 2nd ed., 2005
2)David Sutton. Textbook of Radiology and Imaging. (Seventh edition), 2003.
3) https://radiologykey.com/emerging-imaging-technologies-and-techniques/
4) https://radiologykey.com/cardiovascular-imaging-2/

Key questions covered in lesson 4. Interventional radiology in emergency setting.
Introduction to interventional radiology. Types of guidance and intervention. Extravascular interventions: endobronchial, endobiliary, percutaneous nephrotomy, endoeosophageal, percutaneous drainage of cysts and abscesses, fine needle aspiration cytology (FNAC). Percutaneous surgery on bones and joints. Special tools. The demonstration of the interventional techniques. Endovascular interventions. Types: endovascular dilatation of vessels (angioplasty), endovascular prosthetics (stenting), embolization, installation of inferior vena cava filters, laser tunneling. Advantages and disadvantages. Possible complications, adjustments and measures to prevent them.

Recommended reading for the lesson:
6. Editor: Robert F. Dondelinger. Help. Emergency. 2017. European Society of Radiology (ESR)ISBN: 978-3-9504388-4-0
7. Harris JH, Harris WH, The Radiology of Emergency Medicine. Williams &Wilkins, Baltimore, MD, Fourth Edition, 2000.
8. https://radiologykey.com/interventional-radiology-4/

Methodological instructions for the implementation of independent work on the discipline Emergency Radiology
Every student is given an individual learning project which must be completed. The results should be reported in the form of presentation.
Every group is given one common learning project which must be completed. The results should be reported in the form of presentation.
Topics for projects:
- Imaging of traumatic injuries of the head.
- Imaging of traumatic injuries of the spine.
- Imaging of traumatic injuries of the chest.
- Imaging of traumatic injuries of the abdomen.
- Imaging of traumatic injuries of the pelvis.
- Imaging of traumatic injuries of the upper extremities.
- Imaging of traumatic injuries of the lower extremities.
- Imaging of non-traumatic emergencies of the head.
- Imaging of non-traumatic emergencies of the spine.
- Imaging of non-traumatic emergencies of the thorax.
- Imaging of non-traumatic emergencies of the abdomen.
- Imaging of gynecological emergencies.
- Imaging of obstetrical emergencies.
- Imaging of male genitourinary emergencies.
- Imaging of pediatric fractures.
- Imaging of cardiovascular emergencies.
- Imaging of urinary tract emergencies.
- Imaging of endocrine glands emergencies.
- Imaging of digestive system emergencies.
- Echocardiography.
- Coronary angiography.
- Interventional procedures in cardiac surgery.
- Interventional procedures in oncology.
- Interventional procedures in urology.
- Interventional procedures in neurosurgery.