

ОҢТҮСТІК-ҚАЗАҚСТАН MEDISINA AKADEMIASY «Оңтүстік Қазақстан медицина академиясы» АҚ	 SOUTH KAZAKHSTAN MEDICAL ACADEMY АО «Южно-Казахстанская медицинская академия»
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LECTURE COMPLEX

The name of the discipline is "Visual Diagnostics"

Discipline code VD 5303

Specialty "General Medicine" 6B10101

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Кафедра физиопульмонологии и радиологии

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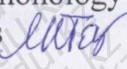
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Departmental discussion held on « 26 » 06 2025 y

Records of meeting № 11

Head Department of Phthisipulmonology and radiology

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1. Topic №1: Radiology of Diseases and Injuries of the Lungs and Mediastinum. Imaging Methods.

2. Objective: To familiarize students with the visual diagnosis of pathological changes in the lungs. To study the fundamental methods of pulmonary radiological imaging.

3. Lecture Theses: Radiological examination is an integral part of the comprehensive evaluation of all patients with thoracic pathology. In most cases, the data obtained are decisive in establishing the nature of the pathological process, as well as in assessing its dynamics and treatment outcomes.

Various radiological methods and techniques can be used to examine patients with diseases and injuries of the lungs and mediastinum. The evaluation usually begins with an X-ray examination. At the first stage, the most accessible native techniques are used: **radiography, fluorography, fluoroscopy, and linear tomography.**

The radiological manifestations of pathological processes in the lungs are quite diverse, but they are based on only four phenomena: **opacification** (shadowing) of the lung fields, **hyperlucency** (brightening) of the lung fields, **changes in the pulmonary pattern**, and **changes in the hila** (roots) of the lungs.

- **Opacification (Shadowing):** Most often caused by the accumulation of inflammatory exudate or edematous fluid in the alveoli, decreased lung aeration due to impaired bronchial patency or lung compression, or the replacement of lung parenchyma with pathological tissues. It should be noted that extrapulmonary processes—such as neoplasms of the chest wall, diaphragm, and mediastinum protruding into the lung fields, or fluid accumulation in the pleural cavities—can also cause this phenomenon.
- **Hyperlucency:** Caused by a decrease in tissue mass per unit volume of the lung. This occurs with an increase in the airiness of the entire lung or a part of it, or when air cavities form in the lung parenchyma. Additionally, hyperlucency may be caused by gas accumulation in the pleural cavity (pneumothorax).
- **Changes in the pulmonary pattern:** Arise due to either the interstitial component or disturbances in blood and lymph flow in the lungs.
- **Changes in the hilar roots:** Caused by lesions of their structural elements: vessels, bronchi, connective tissue, and lymph nodes.

These scialogical (imaging) phenomena can be further detailed depending on their extent, shape, structure, and contours. The analysis of the radiological image must begin with the differentiation between "normal" and "pathological." If pathological changes are present, one should determine which radiological syndrome they manifest; this immediately narrows the range of probable diseases and facilitates differential diagnosis. The next stage is intra-syndromic diagnosis to determine the general nature of the pathological process and the specific nosological form of the disease.

4. Illustrative Material: Negatoscope (view box), X-ray sets, charts, slides.

5. References.

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Main:

Вот перевод вашего списка литературы на английский язык. Принято транслитерировать фамилии авторов и названия издательств, а названия книг переводить для понимания контекста, оставляя оригинальные данные.

1. **Bekmuratov, E. B., et al.** (2016). *Radiology of diseases of the respiratory system and mediastinum: textbook*. Ministry of Healthcare and Social Development of the RK. SKSPPhA (South Kazakhstan State Pharmaceutical Academy). Shymkent. 104 p.
2. **Trufanov, G. E. (Ed.)**. (2015). *Radiology: textbook*. Ministry of Education and Science of the RF; Rec. Sechenov First Moscow State Medical University. Moscow: GEOTAR-Media. 496 p.
3. **Trufanov, G. E. (Ed.)**. (2013). *Radiology: textbook*. Ministry of Education and Science of the RF; Rec. Sechenov First Moscow State Medical University. Moscow: GEOTAR-Media. 496 p.
4. **Iyasova, E. B., Chekhonatskaya, M. L., & Priezzheva, V. N.** (2013). *Radiology: study guide*. Moscow: GEOTAR-Media. 280 p.
5. **Trufanov, G. E. (Ed.)**. (2013). *Radiotherapy: textbook*. Ministry of Education and Science of the RF; Rec. Sechenov First Moscow State Medical University. Moscow: GEOTAR-Media. 208 p.
6. *Radiology of the Chest Cavity Organs*. (2014). Moscow: GEOTAR-Media. 584 p.
7. **Iyasova, E. B.** (2013). *Radiology: study guide*. Moscow: GEOTAR-Media. 280 p.
8. **Filimonov, V. I., et al.** (2010). *Atlas of Human Radiological Anatomy: atlas*. Moscow: GEOTAR-Media.
9. **Khamzin, A.** (2010). *Atlas of Radiological Diagnosis of Normal and Pathological Breasts: atlas*. Almaty.
10. **Vasilyev, A. Yu. (Ed.) & Ternovoy, S. K. (Series Ed.)**. (2010). *Radiology in Pediatrics: National Guidelines*. Moscow: GEOTAR-Media.
11. **Ternovoy, S. K.** (2010). *Radiology and Radiotherapy: study guide*. Moscow: GEOTAR-Media.

Additional References / Supplementary Reading

- **Kokov, L. S. (Vol. Ed.) & Ternovoy, S. K. (Series Ed.)**. (2011). *Radiology of Diseases of the Heart and Blood Vessels: National Guidelines*. Moscow: GEOTAR-Media.
- **Troyan, V. N., Shekhter, A. I. (Vol. Eds.) & Ternovoy, S. K. (Series Ed.)**. (2014). *Radiology of the Chest Cavity Organs: National Guidelines*. Moscow: GEOTAR-Media. 584 p.
- **Burgener, Francis A., Kormanov, M., & Pudas, T.** (2014). *Radiology of Bone and Joint Diseases. More than 1000 Radiographs: Guide and Atlas*. (Trans. from English; Eds. Ternovoy, S. K., & Shekhter, A. I.). Moscow: GEOTAR-Media. 552 p.

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- **Lange, S., & Walsh, G.** (2015). *Radiology of Chest Diseases: Guide and Atlas*. (Trans. from English; Eds. Ternovoy, S. K., & Shekhter, A. I.). Moscow: GEOTAR-Media. 432 p.
- **Trofimova, T. N. (Vol. Ed.) & Ternovoy, S. K. (Series Ed.).** (2013). *Radiology and Radiotherapy of Head and Neck Diseases: National Guidelines*. Moscow: GEOTAR-Media. 888 p.
- **Adamyanyan, L. V. (Vol. Ed.) & Ternovoy, S. K. (Series Ed.).** (2012). *Radiology and Radiotherapy in Obstetrics and Gynecology: National Guidelines*. Moscow: GEOTAR-Media. 656 p.
- **Burgener, Francis A., Korman, M., & Pudas, T.** (2011). *Radiology of Bone and Joint Diseases. More than 1000 Radiographs: Guide and Atlas*. (Trans. from English; Eds. Ternovoy, S. K., & Shekhter, A. I.). Moscow: GEOTAR-Media. 552 p.
- **Vasilyev, A. Yu.** (2010). *Ultrasound Diagnosis in Emergency Pediatric Practice: Guide for Physicians*. Moscow: GEOTAR-Media.
- **Ternovoy, S. K.** (2009). *Computed Tomography: study guide*. Moscow: GEOTAR-Media.

Завершаем оформление вашего списка литературы разделом «Электронные ресурсы». Вот перевод, адаптированный под международные библиографические стандарты:

Electronic Resources:

1. **Trufanov, G. E. (Ed.).** (2011). *Radiology. Vol. 1 [Electronic resource]: textbook*. Moscow: GEOTAR-Media. 416 p. (CD-ROM).
2. **Bekmuratov, E. B., et al.** (2016). *Radiology of diseases of the respiratory system and mediastinum [Electronic resource]: study guide*. Ministry of Healthcare and Social Development of the RK. SKSPPhA. Shymkent. (CD-ROM).
3. **Bekmuratov, E. B., et al.** (2016). *Radiology of diseases of the respiratory system and mediastinum [Electronic resource]: study guide*. Ministry of Healthcare and Social Development of the RK. SKSPPhA. Shymkent. (CD-ROM).
4. **Trufanov, G. E. (Ed.).** (2011). *Radiology. Vol. 1 [Electronic resource]: textbook*. Moscow: GEOTAR-Media. 416 p.
5. **Vasilyev, A. Yu., & Olkhova, E. B.** (2009). *Radiology [Electronic resource]: textbook*. Moscow: GEOTAR-Media. 688 p.
6. **Olkhova, E. B.** (2011). *Ultrasound diagnosis in pediatric uronephrology [Electronic resource]: a course of audio and video lectures for postgraduate education*. Moscow: GEOTAR-Media. (CD-ROM).
7. **Nasnikova, I. Yu.** (2010). *Ultrasound diagnosis [Electronic resource]: study guide and atlas*. Moscow: GEOTAR-Media.
8. **Vasilyev, A. Yu.** (2009). *Radiology [Electronic resource]: textbook*. Moscow: GEOTAR-Media. 688 p. (CD-ROM).
9. *Pediatric Ultrasound Diagnosis [Electronic resource]: monograph*. (2003). Moscow. (CD-ROM).

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10. **Mitkov, V. V. (Ed.).** (2000). *Clinical Guide to Ultrasound Diagnosis. In 5 volumes. Vol. 1 [Electronic resource]: study guide.* Moscow. (CD-ROM).
11. **Pulik, A. V., et al.** (2000). *Methodology for Analyzing CT and MRI Images [Electronic resource]: atlas for medical students, residents, and radiology specialists.* Moscow. (Series "CT and MRI"). (CD-ROM).

6. Control Questions (Self-Assessment):

- Radiological diagnosis of respiratory tract diseases.
- Imaging methods for investigating lung pathology.
- X-ray examination of the respiratory organs.
- Photofluorography (PFG) in respiratory screening.
- Computed Tomography (CT) in the evaluation of respiratory organs.

LECTURE №2

1. Topic: Major radiological symptoms and syndromes of lung diseases.

2. Objective: To introduce students to the key radiological symptoms and syndromes of lung diseases and the diagnostic methods used to identify them.

3. Lecture Theses: The most significant radiological syndromes identified during a chest X-ray examination are:

1. **Total or subtotal opacification.**
2. **Limited opacification** (segmental or lobar).
3. **Focal shadow; limited dissemination.**
4. **Extensive focal dissemination.**
5. **Round shadow.**
6. **Hyperlucency of the lung field.**
7. **Ring-shaped shadow.**
8. **Pulmonary pattern pathology** (weakening, enhancement, or deformation).
9. **Hilar pathology** (unilateral or bilateral).

I. Total or Subtotal Opacification

This refers to the shadowing of the entire lung field (total) or more than 2/3 of it (subtotal) on frontal and lateral radiographs. **Anatomical Basis:**

- Consolidation of lung tissue (loss of aeration).
- Pleural thickening (pleural schwards/scars), including post-pneumonectomy status.
- Pathological content in the pleural cavity (fluid).

Differential Diagnosis Criteria: To differentiate diseases, the following signs are analyzed:

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1. Position of the mediastinum:

- **Shifted toward the opacification:** Atelectasis (bronchial obstruction), cirrhosis (fibrosis), or post-surgical removal of the lung.
- **Shifted away from the opacification:** Massive pleural effusion or diaphragmatic hernia.
- **No shift:** Acute pneumonia (lung volume remains normal).

2. Structure and Intensity:

A homogeneous, high-intensity shadow is typical for atelectasis or large pleural effusions.

Table: Mediastinal Position and Shadow Character | Mediastinal Position | Homogeneous Opacification | Non-homogeneous Opacification | | :--- | :--- | :--- | | **Not shifted** | Inflammatory infiltration | Pulmonary edema | | **Shifted toward shadow** | Atelectasis, Pneumonectomy, Cirrhosis | Pleural schwards (thickening) | | **Shifted away from shadow** | Pleural fluid (Effusion) | Large mass with necrosis/cavitation |

II. Limited Opacification

Shadowing that occupies only part of the lung field.

- **Intrapulmonary:** Moves with breathing and coughing; located within the lung field in all projections.
- **Extrapulmonary:**
 - *Chest wall:* Broadly adjacent to the ribs, moves with them.
 - *Mediastinum:* Part of the central shadow, displaces mediastinal structures. **Common causes:** Inflammatory infiltration (pneumonia), segmental atelectasis, local pneumosclerosis.

III. Focal Shadows and Limited Dissemination

Focal shadows are round or irregular shadows up to 12 mm in size (anatomical basis: the lung lobule).

- **Group of foci:** Several adjacent shadows.
- **Limited dissemination:** Multiple foci within no more than two segments. **Common causes:** Focal tuberculosis, peripheral cancer, metastases, aspiration pneumonia.

IV. Extensive Focal Dissemination

Lesions exceeding two segments (widespread) or affecting both lungs (diffuse). **Classification by size:**

- **Miliary:** up to 2 mm.
- **Small-focal:** 3–4 mm.
- **Medium-focal:** 5–8 mm.
- **Large-focal:** 9–12 mm. **Common causes:** Disseminated tuberculosis, sarcoidosis, carcinomatosis, pneumoconiosis, alveolar pulmonary edema.

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4. Illustrative Material: Radiographs, sonograms (ultrasound), charts, slides.

5. References: (See the list provided in Topic №1).

Main Reading:

1. **Bekmuratov, E. B., et al.** (2016). *Radiology of Diseases of the Respiratory System and Mediastinum: study guide*. Ministry of Healthcare and Social Development of the RK, SKSPhA. Shymkent. 104 p.
2. **Trufanov, G. E. (Ed.)**. (2015). *Radiology: textbook*. Ministry of Education and Science of the RF. Moscow: GEOTAR-Media. 496 p.
3. **Ilyasova, E. B., Chekhonatskaya, M. L., & Priezzheva, V. N.** (2013). *Radiology: study guide*. Moscow: GEOTAR-Media. 280 p.
4. **Trufanov, G. E. (Ed.)**. (2013). *Radiotherapy: textbook*. Moscow: GEOTAR-Media. 208 p.
5. *Radiological Diagnosis of the Chest Organs*. (2014). Moscow: GEOTAR-Media. 584 p.
6. **Filimonov, V. I., et al.** (2010). *Atlas of Human Radiological Anatomy*. Moscow: GEOTAR-Media.
7. **Khamzin, A.** (2010). *Atlas of Radiological Diagnosis of Normal and Pathological Breasts*. Almaty.
8. **Vasilyev, A. Yu. (Ed.)**. (2010). *Radiology in Pediatrics: National Guidelines*. Moscow: GEOTAR-Media.
9. **Ternovoy, S. K.** (2010). *Radiology and Radiotherapy: study guide*. Moscow: GEOTAR-Media.

Supplementary Reading:

1. **Kokov, L. S. (Ed.) & Ternovoy, S. K.** (2011). *Radiology of Diseases of the Heart and Blood Vessels: National Guidelines*. Moscow: GEOTAR-Media.
2. **Troyan, V. N. & Shekhter, A. I. (Eds.)**. (2014). *Radiology of the Chest Organs: National Guidelines*. Moscow: GEOTAR-Media.
3. **Burgener, F. A., Kormanov, M., & Pudav, T.** (2014). *Radiology of Bone and Joint Diseases. More than 1000 Radiographs: Guide & Atlas*. Moscow: GEOTAR-Media. 552 p.
4. **Lange, S. & Walsh, G.** (2015). *Radiological Diagnosis of Chest Diseases: Guide & Atlas*. Moscow: GEOTAR-Media. 432 p.
5. **Trofimova, T. N. (Ed.)**. (2013). *Radiology and Radiotherapy of Head and Neck Diseases: National Guidelines*. Moscow: GEOTAR-Media.
6. **Adamyant, L. V. (Ed.)**. (2012). *Radiology and Radiotherapy in Obstetrics and Gynecology: National Guidelines*. Moscow: GEOTAR-Media.
7. **Vasilyev, A. Yu.** (2010). *Ultrasound Diagnosis in Emergency Pediatric Practice*. Moscow: GEOTAR-Media.
8. **Ternovoy, S. K.** (2009). *Computed Tomography: study guide*. Moscow: GEOTAR-Media.

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Electronic Resources:

1. **Trufanov, G. E. (Ed.).** (2011). *Radiology. Vol. 1 [Electronic Resource]: textbook.* Moscow: GEOTAR-Media. (CD-ROM).
2. **Bekmuratov, E. B.** (2016). *Radiology of Respiratory Diseases [Electronic Resource].* SKSPhA. Shymkent.
3. **Vasilyev, A. Yu. & Olkhova, E. B.** (2009). *Radiology [Electronic Resource]: textbook.* Moscow: GEOTAR-Media.
4. **Olkhova, E. B.** (2011). *Ultrasound Diagnosis in Pediatric Urology: Course of audio-video lectures.* Moscow: GEOTAR-Media. (CD-ROM).
5. **Nasnikova, I. Yu.** (2010). *Ultrasound Diagnosis [Electronic Resource]: atlas.* Moscow: GEOTAR-Media.
6. **Mitkov, V. V. (Ed.).** (2000). *Clinical Guide to Ultrasound Diagnosis [Electronic Resource].* Moscow.
7. **Pulik, A. V., et al.** (2000). *Methodology for Analyzing CT and MRI Images [Electronic Resource]: atlas.* Moscow. (Series "CT and MRI").

6. Self-Control Questions (Control Questions):

1. **Total and Subtotal Opacification Syndrome:**
 - Anatomical basis and key diagnostic signs (mediastinal shift, shadow structure).
2. **Limited Opacification Syndrome:**
 - Characteristics of segmental and lobar involvement; differentiation between intra- and extrapulmonary processes.
3. **Focal Shadow and Limited Dissemination:**
 - Definition of a focal shadow and criteria for "limited" dissemination (within two segments).
4. **Extensive Focal Dissemination Syndrome:**
 - Classification of foci by size (miliary, small, medium, large) and common etiologies.
5. **Round Shadow Syndrome:**
 - Morphological features of solitary pulmonary nodules and masses.
6. **Lung Field Hyperlucency Syndrome:**
 - Causes of increased transparency (pneumothorax, emphysema) and its radiological signs.
7. **Ring-Shaped Shadow Syndrome:**
 - Radiological criteria for cavities (abscess, decaying tumor, tuberculous cavern).
8. **Pulmonary Pattern Pathology:**
 - Identification of weakening, enhancement (vascular congestion), and deformation (fibrosis) of the lung markings.
9. **Hilar Pathology Syndrome:**
 - Analysis of unilateral and bilateral changes in the lung roots (lymphadenopathy, vascular changes).

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LECTURE №3

1. Topic: Main Radiological Syndromes of Oncological Lesions of the Lungs and Pleura.

2. Objective: To familiarize students with radiological methods for examining lung diseases and injuries, respiratory semiotics, and the visual diagnosis of tuberculosis and lung tumors.

3. Lecture Theses:

Foci and Limited Focal Dissemination

These are rounded, polygonal, or irregular shadows up to **12 mm** in size, with the lung lobule as their anatomical basis.

- **Group of foci:** Several adjacent shadows.
- **Limited dissemination:** Multiple foci localized within no more than two segments.
- **Common etiologies:** Focal tuberculosis, peripheral cancer, metastases, lobular atelectasis, and aspiration pneumonia.

Extensive Focal Dissemination Syndrome

Lesions exceeding two segments (**widespread dissemination**) or involving both lungs (**diffuse dissemination**). **Classification by size:**

1. **Miliary:** up to 2 mm.
 2. **Small-focal:** 3–4 mm.
 3. **Medium-focal:** 5–8 mm.
 4. **Large-focal:** 9–12 mm.
- **Common etiologies:** Disseminated tuberculosis, sarcoidosis, carcinomatosis, pneumoconiosis (silicosis), and alveolar pulmonary edema.

Round Shadow Syndrome

A limited opacification that maintains a circular, semi-circular, or oval shape in all projections, measuring **more than 12 mm**.

- **Differential Diagnosis:** It is crucial to determine whether the lesion is intra- or extrapulmonary.
- **Intrapulmonary causes:** Tumors, cysts, tuberculosis (infiltrative or tuberculoma), vascular aneurysms, and lung sequestration.

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Key diagnostic indicators:

- **Peripheral cancer:** A single formation associated with enlarged hilar lymph nodes.
- **Metastases:** Multiple rounded formations.
- **Hamartoma:** A single formation with massive chaotic or "popcorn" calcification.
- **Vascular aneurysm:** A formation showing independent pulsation (under fluoroscopy).

4. Illustrative Material: Negatoscope (view box), radiographs, charts, slides.

5. References: *(The reference list is identical to Topic №1 and №2. Please refer to the previous sections for the translated bibliography).*

6. Control Questions:

- Methods of visual diagnosis for lung diseases and injuries.
- Radiological semiotics of pulmonary diseases.
- Visual diagnosis of tuberculosis and lung tumors.

LECTURE №4

1. Topic: Radiology of Nervous System Pathology.

2. Objective: To introduce students to the visual diagnosis of diseases affecting the organs of the nervous system.

3. Lecture Theses: Radiological methods are of paramount importance in the diagnosis of diseases and injuries of the brain and spinal cord, as they serve as the primary non-invasive ways to visualize their internal structures during life.

Indications for brain imaging include:

- Clinical signs of traumatic injuries.
- Cerebrovascular accidents (strokes).
- Neoplastic (tumors), inflammatory, and infectious diseases.
- General cerebral and focal neurological symptoms.

Indications for spine and spinal cord imaging: Required for evaluating intervertebral discs, bones, and the spinal cord in cases of congenital anomalies, trauma, inflammation, tumors, and degenerative-dystrophic diseases (e.g., osteochondrosis).

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Imaging Methods for the Central Nervous System (CNS)

CT and MRI are the primary modalities for visualizing the brain.

Capabilities of Computed Tomography (CT):

1. Visualizes bones, soft tissues, and associated pathological changes.
2. Differentiates between grey and white matter and the cerebrospinal fluid (CSF) spaces.
3. Visualizes the majority of pathological formations within the brain.

Disadvantages of CT:

- Bone-related artifacts (from the skull base) can limit the detection of focal lesions in the posterior cranial fossa and basal brain regions.

4. Illustrative Material: Negatoscope, sets of radiographs, anatomical charts, slides.

5. References: *(The bibliography remains consistent with previous topics. For neuro-specific study, refer to Trofimova, T. N. (Ed.) "Radiology of Head and Neck Diseases" and Ternovoy, S. K. "Computed Tomography" in your supplementary list).*

6. Control Questions:

- Visual methods for diagnosing diseases of the nervous system.
- Radiological signs of nervous system injuries and diseases across X-ray, CT, MRI, and Ultrasound modalities.

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LECTURE №5

1. Topic: Basic Principles of Cardiac Ultrasound and Vascular Doppler, Angiography, and Coronary Angiography. Cardiac CT and MRI.

2. Objective: To familiarize students with the radiological and visual diagnosis of the cardiovascular system. To study radiological and ultrasound methods for examining the heart and blood vessels.

3. Lecture Theses: The incidence of cardiovascular diseases continues to rise annually, affecting not only the elderly but also young adults and children. Consequently, cardiac ultrasound is now a mandatory preventive examination for newborns (to diagnose congenital defects), individuals over 35, and seniors.

Echocardiography (Cardiac Ultrasound) is a modern, non-invasive method for diagnosing pathologies of the cardiovascular system. It allows for the rapid and accurate determination of most morphological and functional changes occurring in the heart.

- **Main Advantage:** It has no contraindications and is safe for children and pregnant women.
- **Types of Ultrasound:** Transthoracic (TTE) and Transesophageal (TEE).

Radiological Methods (Ventriculography): This is a contrast-enhanced imaging technique used to evaluate the contractile function of the heart's ventricles, the condition of the heart valves, and changes in the configuration of the ventricular cavities due to aneurysm, ischemia, or myocardial hypertrophy.

- **Procedure:** Unlike standard angiography, the contrast agent is typically injected, followed by a series of rapid-exposure radiographs to capture the heart's motion.

4. Illustrative Material: Sonograms (ultrasound images), data tables, slides.

5. References: *(Please refer to the translated bibliography in Topics №1–4. For this specific topic, the most relevant resource is **Kokov, L. S. (Ed.) "Radiology of Diseases of the Heart and Blood Vessels: National Guidelines"** from your supplementary list).*

6. Control Questions:

- Radiological diagnosis of the cardiovascular system.
- Ultrasound diagnosis of the cardiovascular system.
- Advantages of ultrasound in cardiac evaluation.
- Contraindications to radiological and ultrasound diagnostics.
- Indications for performing radiological and ultrasound examinations of the cardiovascular system.

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LECTURE №6

1. Topic: Main Radiological Syndromes of the Cardiovascular System. Principles of Cardiac Ultrasound, Vascular Doppler, Angiography, and Coronary Angiography. Cardiac CT and MRI.

2. Objective: To familiarize students with the radiological and visual diagnostics of the cardiovascular system. To study radiological, ultrasound, and advanced cross-sectional imaging methods for the heart and vessels.

3. Lecture Theses: The prevalence of cardiovascular diseases is increasing globally, affecting all age groups from newborns to the elderly. Consequently, cardiac imaging has become a cornerstone of both preventive medicine and emergency diagnostics.

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Ultrasound and Doppler Studies

Echocardiography (Cardiac Ultrasound) is a modern, non-invasive method for diagnosing cardiovascular pathologies. It accurately identifies morphological and functional changes.

- **Transthoracic (TTE):** Performed through the chest wall; the standard primary screening method.
- **Transesophageal (TEE):** Performed via the esophagus; provides higher resolution images of the posterior heart structures and valves.
- **Dopplerography:** Used to evaluate blood flow velocity, direction, and turbulence within the heart and peripheral vessels.

X-ray and Invasive Methods

Ventriculography and Angiography: These involve the use of contrast media to visualize the heart chambers (ventricles), valves, and vessel patency.

- **Ventriculography:** Evaluates myocardial contractility and identifies aneurysms or hypertrophy.
- **Coronary Angiography:** The "gold standard" for visualizing coronary artery disease and planning interventions like stenting.

Advanced Imaging: CT and MRI

- **Cardiac CT (MSCT):** Excellent for visualizing coronary calcium scores and non-invasive coronary angiography. It provides high-quality images of the vessel walls and heart anatomy.
- **Cardiac MRI:** The superior method for tissue characterization. It is used to assess myocardial viability, identify scarring (fibrosis) after a heart attack, and diagnose cardiomyopathies.

4. Illustrative Material: Sonograms, coronary angiograms, CT/MRI reconstructions, tables, and slides.

5. References: *(The bibliography remains the same as in previous topics. For clinical details on advanced imaging, refer to Kokov, L. S. (Ed.) "Radiology of Heart and Vascular Diseases" and Ternovoy, S. K. "Computed Tomography").*

6. Control Questions:

- Radiological diagnosis of the cardiovascular system.
- Ultrasound diagnostics (Echocardiography) of the cardiovascular system.
- Advantages of ultrasound in cardiac evaluation compared to invasive methods.

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- Contraindications and safety profiles for X-ray (contrast) vs. ultrasound diagnostics.
- Indications for coronary angiography and cardiac MRI in clinical practice.

LECTURE №7

1. Topic: Radiology of Gastrointestinal Tract (GIT) Diseases. X-ray Semiotics. The Role of Ultrasound and CT in the Diagnosis of Liver, Pancreas, Gallbladder, and Bile Duct Pathologies.

2. Objective: To familiarize students with the visual diagnosis of the digestive organs. To study the radiological features of the esophagus, stomach, pancreas, small intestine, and large intestine, as well as diagnostic methods for the digestive system.

3. Lecture Theses:

Methods of Investigation

- **Plain Abdominal Radiography:** Primary method for suspected hollow organ perforation or intestinal obstruction.
- **Contrast Studies:** Fluoroscopy of the esophagus, stomach, and duodenum; barium swallow; intestinal passage study; and **barium enema (irrigoscopy)**.
- **Contrast Agents:** Gas (negative contrast), Barium sulfate (standard), and water-soluble iodine contrast (mandatory if perforation is suspected).

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Radiological Semiotics (Key Symptoms)

- Narrowing or deformation of the lumen.
- Dilation (expansion) of the lumen.
- **Filling defect:** A space occupied by a tumor or foreign body.
- **Niche (Contrast depot):** Typical for ulcers (contrast fills a crater).
- Changes in mucosal relief (folds).
- Impaired elasticity and peristalsis.

Esophageal Pathology

Radiology helps identify:

- **Diverticula:** Outpouching of the wall.
- **Achalasia/Cardiospasm:** Failure of the lower sphincter to relax.
- **Hiatal Hernia:** Part of the stomach protruding through the diaphragm.
- **Tumors:**
 - * *Benign:* Smooth contours, preserved mucosal folds and elasticity.
 - *Malignant:* Irregular "moth-eaten" contours, rigid walls, atypical relief, and impaired passage.

Stomach and Duodenum

- **Gastric Ulcer:** The direct sign is a "**niche**" on the contour or relief.
- **Gastric Cancer:** Irregular filling defects, rigidity of walls (aperistaltic zones), and atypical mucosal relief.
- **Contraindications for Barium meal:** While often used for gastritis, acute gastrointestinal bleeding is a relative contraindication for barium use due to interference with endoscopy.

Large Intestine (Irrigoscopy)

- **Indications:** Tumors, diverticulosis, and destructive colitis (Crohn's disease, Ulcerative colitis).
- **Intestinal Obstruction Signs:** Presence of **Kloiber's cups** (fluid levels with gas bubbles above them) and significant peripheral distension of the colon.

Liver, Gallbladder, and Pancreas

- **Ultrasound (US):** The primary screening method for gallstones, cholecystitis, and liver cysts/tumors.
- **CT/MRI:** Used for detailed staging of pancreatic cancer, liver metastases, and complex biliary tract obstructions.

4. Illustrative Material: Negatoscope, radiographs (barium studies), ultrasound images, CT slides.

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5. References: (*Refer to the bibliography provided in previous topics. Key texts: Trufanov, G. E. for general radiology and Ilyasova, E. B. for digestive system specifics*).

6. Control Questions:

- Radiological features of the digestive system.
- Visual diagnosis of esophageal diseases.
- Visual diagnosis of stomach diseases (Ulcer vs. Cancer).
- Visual diagnosis of pancreatic pathologies (The role of US/CT).
- Visual diagnosis of the small and large intestines (Signs of obstruction).

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LECTURE №8

1. Topic: Visualization Methods (MRI, CT, Ultrasound, Scintigraphy, Arthroscopy, etc.) for Musculoskeletal System Pathology: Indications, Rules, and Diagnostic Value.

2. Objective: To introduce students to radiological methods for examining the musculoskeletal system. To study the radiological semiotics of the locomotor system, indications, and contraindications. To identify radiological signs of arthritis, arthrosis, and osteomyelitis.

3. Lecture Theses:

Radiological examination remains the primary, and often only, method for diagnosing congenital and acquired bone diseases, deformities, growth arrest, and traumatic injuries.

Core Imaging Modalities

- **Conventional X-ray:** The baseline for almost all bone pathologies.
- **Linear Tomography:** Useful for complex anatomical structures (skull, spine, large joints) to obtain an isolated view of a specific bone layer.
- **Computed Tomography (CT):** Provides detailed visualization equivalent to an anatomical cross-section. Essential for assessing bone structure, complex fractures, and soft tissue involvement.
- **Magnetic Resonance Imaging (MRI):** The superior method for visualizing soft tissues (ligaments, tendons, cartilage, bone marrow) surrounding the bones.
- **Scintigraphy (Radionuclide scanning):** Used to detect early metabolic changes (metastases, early osteomyelitis) before they are visible on X-ray.

Radiological Signs of Joint Pathology

I. Deforming Arthrosis (Osteoarthritis) A degenerative-dystrophic disease caused by mechanical overload. Key signs:

1. **Narrowing of the joint space:** Due to cartilage destruction.
2. **Subchondral Sclerosis:** Thickening and flattening of the bone plates under the cartilage.
3. **Osteophytes (Bone spurs):** Marginal bone growths to increase the surface area and reduce pressure.
4. **Intra-articular loose bodies:** Fragments of bone or cartilage within the joint cavity.

II. Reactive Arthritis An immuno-inflammatory joint disease occurring alongside or after an infection. Key signs:

- **Periarticular Osteoporosis:** Bone thinning around the joint during chronic inflammation.
- **Erosive lesions:** Destruction of the joint surfaces.
- **Cystic changes:** Translucent areas in the bone epiphyses.
- **Enthesopathy:** Bone growths at the insertion sites of the Achilles tendon or plantar fascia.

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- **Specific localization:** Commonly affects the interphalangeal joint of the big toe.

III. Osteomyelitis Radiological signs usually appear 10–14 days after clinical onset.

- **Bone destruction:** Irregular areas of bone loss.
- **Periosteal reaction:** Layering or "lifting" of the periosteum.
- **Sequestration:** Fragments of dead bone detached from the healthy tissue.

4. Illustrative Material: Negatoscope, radiographs (fractures, arthrosis), CT/MRI scans, slides.

5. References: (Refer to the main bibliography list. Specifically for this topic: **Burgener, F. A. "Differential Diagnosis in Conventional Radiology"** and **Filimonov, V. I. "Atlas of Human Radiological Anatomy"**).

6. Control Questions:

- Main methods of musculoskeletal system examination.
- The role of CT in bone-joint pathology.
- The role of MRI in evaluating soft tissue components of joints.
- Radiological semiotics of the bone system (Destruction, Sclerosis, Osteoporosis).
- Radiological signs of Arthrosis vs. Arthritis.
- Radiological diagnosis of Osteomyelitis.

LECTURE №9

1. Topic: Visual Diagnosis of Endocrine System Diseases: CT, MRI, and Radionuclide Studies.

2. Objective: To familiarize students with the visual diagnosis of the adrenal glands and study the radiological methods used for their examination.

3. Lecture Theses:

Imaging methods provide essential support to clinicians in recognizing adrenal lesions.

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- **Conventional X-ray:** Generally ineffective as normal adrenal glands are not visible. However, in cases of **Addison's disease** (often linked to tuberculosis), small lime deposits (calcifications) may be observed.
- **Sonography (Ultrasound):** The most accessible method, though normal or slightly enlarged glands are not always clearly visualized.

Computed Tomography (CT) – The Leading Method

CT is the primary modality for adrenal imaging.

- **Location:** Identified as structures above and slightly anterior to the upper pole of the kidney.
- **Appearance:** Normal glands appear as small oval or triangular formations with straight or convex contours.
- **Sensitivity:** CT can detect tumors as small as **0.5–1.0 cm**. Tumors typically cause enlargement and deformation of the gland.

Magnetic Resonance Imaging (MRI) and Scintigraphy

- **MRI:** Considered even more sensitive than CT, particularly for confirming **adrenal cortical hyperplasia**.
- **Scintigraphy:** A functional imaging method developed to assess the activity of both the adrenal cortex and medulla.

Clinical Syndromes and Imaging Strategy

Adrenal dysfunction manifests through specific clinical and laboratory data:

- **Itsenko-Cushing Syndrome:** Often caused by bilateral adrenal cortical hyperplasia (frequently due to a pituitary adenoma).
- **Conn's Syndrome (Primary Aldosteronism):** Usually caused by hyperplasia or a benign adrenal adenoma.
- **Pheochromocytoma:** Leads to symptomatic hypertension.
- **Metastatic Disease:** The adrenal glands are common sites for metastases, most frequently from **breast and lung cancer**. This must be considered during clinical radiological screenings.

4. Illustrative Material: Negatoscope, radiographs (showing calcifications), tables, slides.

5. References: (Refer to the core bibliography. Key resources for this topic include **Trufanov, G. E. "Radiology"** and **Ternovoy, S. K. "Computed Tomography"**).

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6. Control Questions:

- Visual diagnosis of the adrenal glands: primary challenges and solutions.
- Capabilities of CT and MRI in detecting adrenal tumors and hyperplasia.
- The role of scintigraphy in evaluating the adrenal cortex and medulla.
- Identifying metastatic lesions in the adrenal glands during oncological screening.

LECTURE №10

1. Topic: Radiology of the Urinary and Reproductive System Diseases.

2. Objective: To familiarize students with the visual diagnosis of the urinary system organs and to study radiological diagnostic methods used in urology.

3. Lecture Theses: Modern imaging techniques allow for the detailed study of both the **morphology** (structure) and the **function** of the kidneys, ureters, and bladder. A clear understanding of normal radiological anatomy is essential for accurate diagnosis.

Key Diagnostic Methods

- **Ultrasound (US):** The primary screening tool.
- **X-ray Methods:** Plain radiography, Intravenous Urography (IVU), Retrograde Pyelography, Renal Angiography, and Cystography.
- **Advanced Imaging:** Computed Tomography (CT) and Magnetic Resonance Imaging (MRI).

Ultrasound Diagnosis (Sonography)

Ultrasound is widely used in urological practice as it is non-invasive, radiation-free, and highly informative regarding morphological changes.

Note: Ultrasound provides excellent visualization of structure but **does not assess renal function**.

Indications for Renal Ultrasound:

- Pain in the kidney area or along the ureters.

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- Suspected renal tumor or polycystic kidney disease.
- Kidney trauma.
- Hematuria (blood in the urine).
- Suspected "silent" (non-functioning) kidney.
- Urinary tract infections (UTI).

Patient Preparation and Procedure:

- **Preparation:** It is advisable to avoid gas-producing foods (dark bread, milk, legumes) for several days prior.
- **Bladder:** The patient must have a full bladder for a proper examination.
- **Technique:** The study is usually conducted in the supine position (lying on the back) during deep inspiration. Additional scans are performed in the sitting position and on the sides (lateral decubitus) using sagittal, frontal, and transverse planes.

4. Illustrative Material: Negatoscope, radiographs (urograms), ultrasound scans, anatomical tables, and slides.

5. References: (*Refer to the core bibliography. Key resource: Trufanov, G. E. "Radiology" and the supplementary resource Vasilyev, A.Y. "Radiology in Pediatrics" for congenital anomalies.*)

6. Control Questions:

- Radiological features and normal anatomy of the urinary system.
- **Intravenous Excretory Urography:** Procedure and diagnostic value.
- **Pyelography vs. Cystography:** Indications and differences.
- **Renal Angiography:** When is it necessary?
- Comparative value of **US, CT, MRI, and Radionuclide Renography** in assessing kidney function and structure.

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