

BOGOMOLETS NATIONAL MEDICAL UNIVERSITY

Department of human anatomy

**GUIDELINES**

**Students' independent work during preparation to practical lesson**

<i>Academic discipline</i>	HUMAN ANATOMY
Module №	2
Content module №	5
The theme of the lesson	Anatomy of the lymphoid vessels
Course	I
Faculties	Medical 1,2,3,4, military, dental
The number of hours	3

1. **Actuality**: The lymphatic system is morphologically and functionally part of a circulatory and immune systems, and endowed with all the characteristics of large systems: the presence of targets the complexity of behavior, stability and reliability. Differences lymphatic system, a part of the immune, determine the objectives of its operation - the release of internal environment from products with alien genetic information designated as antigens. To this end, the lymphatic system has branched in organs and tissues of the lymphatic capillaries limfokapilyarni grid, lymph vessels, trunks and ducts. On the road there are numerous lymph flow lymph nodes that are biological filters lymph that flows through them. Over the past years, the clinic introduced methods of surgical reconstruction of lymphatic and venous vessels - artificial anastomosis for the treatment of severe edema caused by the severe changes in lymphatic vessels. Commonly used methods of draining lymph ducts and shafts for the purpose of detoxification; endolymphatic administration of drugs for the correction of certain disorders in the body Knowledge phasing lymph is important in determining clinical pathways for tumor metastasis and inflammatory processes - is the basis of clinical thinking in the conditions for the differential diagnosis of any medical specialty.

2. **Specific objectives**:

After the classes the student should know and be able to:

2. 1. Describe the principles of phasing limf of formulated founder Ukrainian lymphology professor F.A.Stefanisom.

2.2. Identify the structural components of the lymphatic system, as part of a single vascular and immune systems.

2.3. To determine the function of the lymphatic system.

2.4. To be able to determine the structural features limfokapilyariv, design limfokapilyarnyh nets in various organs.

2.5. To characterize structural features of lymphatic vessels, lymphatic plexus.

2.6. To be able to determine formation, topography lymphatic trunks into which they flow duct.

2.7. Describe the departments of education, topography, the confluence of the venous system thoracic duct and right lymphatic ducts. Analyze the areas from which they collect lymph.

2.8. Describe the parietal and visceral lymph nodes of the abdomen, chest, pelvis. Identify the features of their topography.

Analyze, in which groups of lymph nodes lymph flowing from the walls of the abdomen, pelvis, thorax.

2.10. Identify the features of certain lymph outflow of pelvic, abdominal

and thoracic cavities.

2.11. Identify features outflow of lymph from the breast (chest climb).

**3. Baseline study** (interdisciplinary integration) student incorporates the knowledge of medical biology and histology of lymphoid development (immune) of the peculiarities of hematopoiesis in human ontogenesis (embryonic hemotsytopeny, liver hematopoiesis, bone and brain blood forming organs).

Before classes a student should know and be able to:

3.1. Identify the main tasks of modern immunology its clinical orientation.

3.2. Know the classification of lymphoid (immune) bodies.

3.3. Identify the features of blood formation in human ontogenesis (embryonic hemotsytopeny, liver hematopoiesis, bone and brain blood forming organs).

3.4. Describing the features of the structure and function of red bone marrow.

3.5. To determine the direction of differentiation of bone marrow stem cells into working cells of the immune system.

3.6. Identify the structural features of lymph nodes and its functions. Describe the structure of the structural components of the lymph nodes, especially their shape classification function.

3.8. To determine the structure and function of the spleen.

3.9. To determine the structure and function of the tonsils, lymphoid lesions in the walls of the digestive, respiratory and urinary systems.

3.10. To demonstrate and call lymph nodes of the head and neck.

3.11. Knowing the structure of large and small circles of circulation, able to explain the functions of the main parts of the cardiovascular system.

#### **4.4. Tasks for independent work during preparation for practical lessons**

4.1. Questions to control the entry level of students' knowledge

1. Determine the phasing principles formulated by the founder of the Kiev Ukrainian lymphology Professor FA Stefanisom.

2. What lymphoid tissue cells formed?

3. Which of the structure of lymphoid organs?

4. What are the morphological characteristics typical of primary and secondary lymphoid (immune) of?

5. What are the structure and function of lymph nodes? What they have functional characteristics?

6. In which structural components are preferably lymph node postcapillary

venules of high endothelial? What is their function?

7. Sinuses which occurs in the lymph nodes of the lymph vessels to the lymph prynosnyh remote?

8. What are the structural components of different lymphatic capillaries of the blood capillaries?

9. What are the structural features of lymphatic vessels?

10. What lymphatic vessels of the classic concepts presented lymphatic system?

11. How lymph formed? What are the cellular components of form? How many lymph circulating in the human body?

12. In which organs and tissues are no limf capillaries?

13. What group of lymph nodes of the head and neck. Where lymph flowing from them?

#### 4.2. Questions to control the final level of training

1. Chym targeting different lymph capillaries in the internal organs and form a flat (fascia, serous membranes, skin, walls of hollow organs and large blood vessels)?

2. What are the structural features of lymphatic capillaries? How do they differ from blood capillaries?

3. What makes the movement of lymph capillaries to lymph vessels?

4. What limfokapilyarni arhitektonikoyu grid, orientation lymphatic capillaries and their density you know?

5. Which of the characteristic three-dimensional grid limfokapilyarni?

6. Who is form a grid located in the same plane?

7. What is the characteristic feature of lymphatic vessels?

8. What is the structure of the lymphatic valve (the valve)?

9. What is "limf"?

10. How lymph vessels are divided regarding the lymph nodes, where they interrupted towards the venous system?

11. Which are lymph trunks? How are they formed?

12. Where trunks and lymph flow ducts?

13. What are the parts of the body take jugular and subclavian lymph trunks?

14. In that trunk lymph flowing from the walls and the chest cavity?

15. Which trunk lymph flowing from the walls and the abdominal cavity and pelvis?

16. What is the thoracic duct sections? How is it formed?

17. The right lymphatic duct is formed?

18. Where falls right lymphatic duct and thoracic duct? What are the parts of the body enters the lymph to each of them?

19. What do you know of pelvic lymph node groups?
20. Which groups of lymph nodes lymph flowing from the pelvic organs, including the colon, bladder and uterus?
21. Which group wall surface lymph nodes of the abdomen, you know? From which sites they accept lymph?
22. Which group nutroschevyh abdominal lymph nodes, you know? Which of lymph flowing to each of them?
23. In which lymph nodes lymph flowing from the stomach?
24. In which lymph nodes lymph flowing from the liver?
25. In which lymph nodes lymph flowing from the pancreas and duodenum?
26. Which group of lymph nodes wall surface of the chest, you know? Which of lymph flowing to each of them?
27. Which group nutroschevyh lymph nodes chest, you know? Which of lymph flowing to each of them?
28. In which lymph nodes lymph flowing from the lungs?
29. What are the outflow of lymph from the breast (breast cancer)? In which lymph nodes lymph flowing from it?
30. In which lymph nodes lymph flowing from the diaphragm?

#### **4.3. The content of the material.**

The lymphatic system (systema lymphoideum) morphologically and functionally integrated with the circulatory system is part of a circulatory and immune systems. In humans, there is a system of defense against foreign cells, infectious agents and other substances with antigenic properties. This feature of the body called antigens to the immune system (from the Latin word *immunitas* - exemption anything) that provides a constant internal environment preservation and defense reactions. Back in the 70s of the twentieth century introduced the term - the immune system that integrates all lymphoid organs of lymphoid cells in other organs. The feature of this system is its generalization throughout the body and its cells are continuously circulating through the blood and lymph channel. Immune organs constructed from lymphoid tissue represented reticular stroma, which are lymphoid cells - different subpopulations of T and B lymphocytes, which provide an immune response to antigens using lymphocytes - effectors. In a plasma-effector cells produce specific immunoglobulins - antibodies and provide humoral immunity. T-killer cells are T-effector cells and neutralize foreign cells, providing cellular immunity.

The lymphatic system (systema lymphoideum) consists of branched organs and tissues of the lymphatic capillaries nets, lymph vessels, shafts and ducts. On the road there are numerous lymph flow lymph nodes that are

biological "filter" for lymph that flows through them.

The lymphatic system is represented by:

Limfocapillies vessel (Vas lymphocapillare)

Limfocapillies net (Rete lymphocapillare)

Lymphatic vessels (Vas lymphaticum)

The lymphatic plexus (Plexus lymphaticus)

Lots of lymph nodes (Nodi lymphoidei regionales)

Lymphatic trunks (Trunci lymphatici)

Lymph duct (Ductus lymphatici)

Confluence lymph into the venous system:

Left venous angle (thoracic duct)

The right venous angle (right lymphatic duct)

The term "lymphatic system (systema lymphoideum)" comes from the Latin word *lympha* - clean water source, and the Greek word *nympha* - bride Goddess clean sources, oak forests and mountains.

**The function of the lymphatic system.** Because lymphatic capillaries interstitial fluid is absorbed, which in lymphatic vessels get the products of cellular metabolism, cells, sometimes even red blood cells, foreign substances, including various antigens - pieces of dead cells and tissue elements, mutant cells, bacteria, viruses and more. In the lymph nodes lymph "filtered" and cleared of these products. Macrophages antigens "recycle" them and transmit information immune lymphocytes. So start the process proliferation and differentiation of subpopulations of T and B lymphocytes, formed specific immune response. Thus, the lymphatic system is protective.

Lymph (*lympha*) formed by the absorption of interstitial fluid in the capillaries of the lymphatic system. It is a colorless, clear liquid, which is similar to on biochemical composition of blood plasma. The main elements of the cell lymphomas (96-98%) are lymphocytes. In adult lymphatic system circulates about two liters of lymph. If people ate a lot of fatty foods, the lymph that flows from the gut becomes white as milk (latex, chylus). Chylus Greek word meaning "artificially prepared juice." This term is called intestinal lymph lymphatic vessels.

Opening lymphatic vessels associated with the name of the XVII century Italian anatomist Gasparo Azelli (1581-1626). In 1622, demonstrating to students the diaphragm moves in a live dog he found in the mesentery of the small intestine vessels that were filled with whitish molokopodibnym content. It turned out that before the experiment the dog fed fatty food. Azelli called these vessels dairy and believed that they are "white blood",

or latex (chyle) in the liver. Later, after the death Azelli, it was found that these lymph vessels flowing into the venous system. Through research known anatomists Moskanyi P. (1787), F. Sappeya (1885), GM Joseph (1870-1933), H.Ruv'yera (1932), academicians DA Zhdanov (1908-1972) and MR Sapignies but especially thanks to the work of Ukrainian-anatomists limfolohiv Kyiv School of FA Stefanisa (1865-1917), MS Spirovo (1896-1972), AA Drying (1899-1970), AI Sviridov (1900-1973) was created doctrine of the lymphatic system.

The lymphatic system is represented by:

Limfokapilyarna vessel (Vas lymphocapillare)

Limfokapilyarna net (Rete lymphocapillare)

Lymphatic vessels (Vas lymphaticum)

The lymphatic plexus (Plexus lymphaticus)

Lots of lymph nodes (Nodi lymphoidei regionales)

Lymphatic trunks (Trunci lymphatici)

Lymph duct (Ductus lymphatici)

Lymph capillaries

The lymph capillaries present in all organs except:

- brain and spinal cord and their membranes,
- plate epithelial skin and mucous membranes;
- inner ear;
- cartilage, cornea and lens of the eyeball;
- parenchyma of the spleen, bone marrow and other lymphoid organs of the immune system;
- placenta, umbilical cord;

Lymphatic trunks

Lymphatic vessels merge to form lymphatic trunks (trunci lymphatici), in which the lymph flowing from relevant parts of the body to the lymph ducts. The human body can be 8-11 lymph trunks. The following lymph trunks.

Jugular trunk - right and left (truncus jugularis dexter et sinister), formed from the side remote vessels deep cervical lymph nodes. It takes lymph from the corresponding (right or left) half of the head and neck. Right jugular trunk falls mainly into the right lymphatic duct or the right venous angle, is the final section of the right internal jugular vein. The left jugular trunk falls frequently in the cervical thoracic duct or of the left venous angle, is the final section of the left internal jugular vein.

Subclavian trunk - right and left (truncus subclavius dexter et sinister),

formed from remote vessels axillary lymph nodes. It takes lymph from the corresponding (right or left) of the upper limb. Right subclavian trunk falls in most cases, the right lymphatic duct or the right venous angle, is the final section of the right subclavian vein, the left - the final division thoracic duct or vein in the left corner, or left subclavian vein.

Broncho-mediastinal trunk - right and left (truncus bronchomediastinalis dexter et sinister) formed from remote vessels tracheobronchial lymph nodes. It takes lymph organs and walls of the respective half (right or left) of the chest cavity. Right broncho-mediastinal trunk falls mainly into the right lymphatic duct or directly into the right venous angle left - the final division thoracic duct or vein in the left corner.

Lumbar trunk - right and left (truncus lumbalis dexter et sinister) formed in the lumbar area of the remote lymphatic vessels lumbar lymph nodes located around the abdominal aorta and inferior vena cava. In the lumbar lymph trunks flowing from the corresponding (right or left) of the lower limbs, organs and pelvic walls. At the confluence of the right and left lumbar trunks formed thoracic duct.

Intestinal trunks (trunci intestinales) - is some occasional vessels (about 25% of people), formed from remote lymphatic vessels mesenteric lymph nodes. Intestinal trunks fall of abdominal thoracic duct or lumbar trunks.

Trunci et ductus lymphatici Lymphatic trunks and ducts

Truncus jugularis jugular trunk

Truncus subclavius subclavian trunk

Plexus lymphaticus axillaris axillary lymph plexus

Truncus bronchomediastinalis Broncho-mediastinal trunk

Ductus lymphaticus dexter; Ductus thoracicus dexter right lymphatic duct;

Right thoracic duct

Arcus ductus thoracici Arc thoracic duct

Pars cervicalis; Pars colli cervical part

Chest of pars thoracica

Pars abdominalis abdominal part

Cisterna chyli Milk tank

Lumbar trunk truncus lumbalis

Intestinal trunks Trunci intestinales

The lymph ducts

Lymph duct (ductus lymphatici) formed by the merger of the lymph trunks. There are two lymphatic ducts - right lymphatic duct and the thoracic duct.

The right lymphatic duct (ductus lymphaticus dexter) is a vessel with a length of 10-15 mm. It is formed by the confluence of the right bronchial-mediastinal jugular and subclavian trunks which open into the right venous angle formed at the junction of right internal jugular and subclavian veins. In 75-80% of cases the right lymphatic duct is missing, then the trunks that would make it independently open into one of the veins, venous forming a right angle. The right lymphatic duct receives lymph from the right half of the head and neck, right upper extremity, and the walls of the right half of the chest cavity.

The thoracic duct (ductus thoracicus)

The functional importance of the thoracic duct, known as "white vein" was first found by the student of the University of Paris (1622-1674). Experimentally in 1647 he found that lymph from the abdominal cavity moves to the thoracic duct, which flows into the veins of the neck.

The man who described the thoracic duct was O. Rudbeck (1651) and F. Bartolini (1652). Valves in the lymph vessels were described by Ryuyil F. (1655).

The thoracic duct (ductus thoracicus) - Peke channel is formed in the retroperitoneal tissue at the confluence of the right and left lumbar trunks at the level of the second lumbar - twelfth thoracic vertebrae. Sometimes it involves the formation of intestinal trunks. The thoracic duct has a length of 30-40 cm, consists of abdominal, thoracic and cervical parts.

Abdominal part (pars abdominalis) starts at 75% of the people extension or lymph collector - milk tank (cysterna chili) - Peke tank. In other cases, the thoracic duct begins at the cisterna chyli lymphatic plexus trunks that form it. It merges with the right leg diaphragm movements which contribute to leakage of lymph.

In the belly of the strait directly open remote lymphatic vessels adjacent lymph nodes.

The rib portion (pars thoracica) of the thoracic duct is situated in front of the spine between the aorta and the odd vein, the entire esophagus. In the upper chest cavity the duct is directed left and goes through the top hole in the chest area of the neck. In December of flow ducts remote intercostal lymph vessels lymph nodes and posterior mediastinal nodes.

Cervical part (pars cervicalis; pars colli) of the thoracic duct at VII-V cervical vertebrae deviates to the left, forming a convex upward curve (arcus ductus thoracici), envelope left dome of the pleura, goes down and flows into the left venous angle. In other cases it opens into the final sections of veins that form this angle. In the cervical thoracic duct flow of the left

jugular, subclavian and broncho-mediastinal trunks. Often these trunks open into the veins themselves. At the mouth of the thoracic duct is paired valve that prevents the entry of venous blood in the duct. Along the thoracic duct valves are 7-9. A valve system and a well-developed middle muscular layer of the wall of the thoracic duct lymph facilitate movement. In 50% of cases of thoracic duct before falling into a vein expanding, often divides. Thus, the thoracic duct receives lymph from both lower extremities, and the walls of the abdominal cavity, and the walls of the left half of the chest cavity, the left half of the head and neck, the left upper extremity.

So lymph from different parts of the body enters the two lymphatic ducts - right lymphatic duct and thoracic duct, which flow in the superior vena cava.

### Lymphatic vessels and lymph nodes body parts

Depending on the location of lymph nodes and lymph in the direction of the lymphatic vessels emit (*nodi lymphatici regionales*), which collect the lymph from certain parts of the body (from the Latin region - site). These groups are called lymph nodes from areas where they are located (eg, occipital, axillary, lumbar, inguinal), or from large vessels near which they are located (abdominal, jugular, top ripple external and internal iliac etc.). Groups of lymph nodes are superficial fascia over the surface called lymph nodes (*nodi lymphatici superficiales*), and those nodes that are located deep under the fascia called deep lymph nodes (*nodi lymphatici profundi*). Lots of lymph nodes to which lymph flowing from the bodies of the muscul system (popliteal, inguinal, elbow, axillary etc.) or from the walls of the body (Intercostal, epigastric etc.) are called somatic lymph nodes (*nodi lymphatici somatici*). This name comes from the Greek word soma - body. These units are called parietal lymph nodes (*nodi lymphatici parietales*), from Latin paries - wall.

Those nodes that are only internal organs (for example, broncho-pulmonary, stomach, mesentery, liver) are called (*nodi lymphatici viscerales*). Units taking lymph from both internal organs and from the muscles, fascia, joints, skin (eg, deep lateral cervical lymph nodes) are called mixed lymph nodes (*nodi lymphatici mixti*).

Preferably somatic lymph nodes are located in areas of bending the body surface groups, each of which can total several tens of nodes. For example, an adult inguinal lymph nodes has 4-20, axillary - 12-45, and mesenteric - 66-410.

**Practical concerns.** Knowledge of the topography and structure options thoracic duct urgently needed in the clinic. In some diseases (peritonitis, burn disease, etc.) there is intoxication. In such cases, carry out drainage of the cervical and thoracic duct lymph taken for cleaning. Practiced as the introduction of drugs into the neck of the thoracic duct.

## LITERATURE

### Main:

1. Holovatsky A. S., Cherkasov V. G., Sapin M. G., Paron A. //human Anatomy, vol. 2 Nova knyga, Vinnytsia, 2015.- 12-16 y., p. 17-28, 37-41p.

### Additional:

Sviridov, A. I. human Anatomy // Higher school, Kyiv, 2001.- 399 y.

1. Cherkasov V. G. //the senses ( structure and function), Kiev, 2003.- 211p.

[www.anatom.ua](http://www.anatom.ua)

Tests "STEP - I»

1. The doctor, the patient, 61 years, in order to clarify the diagnosis, aims to lymph from the right lymphatic duct in the area of the confluence of venous bed. What is the plot?

- A. Right venous angle.
- B. The left venous angle.
- C. Place the formation of the inferior vena cava.
- D. Place the formation of the superior vena cava.
- E. Place formation Brachiocephalic vein.

2. The patient revealed aortic aneurysm at the roots of the merger thoracic duct. Clinical manifestations of compression are: swelling of the lower limbs ( "elephant's disease"), stagnation in the abdominal cavity. What form the thoracic duct trunks?

- A. Truncus lumbalis dexster et sinister.
- B. Truncus jugularis dexter et truncus subclavius dexter.
- C. Truncus subclavius dexster et sinister.
- D. Truncus jugularis dexster et sinister.
- E. Truncus jugularis sinister et truncus subclavius sinister.

3. The doctor, the patient, 50 years old, in order to clarify the diagnosis, aims to lymph from the thoracic duct in the area of the confluence of venous bed. What is the plot?

- A. The left venous angle.
- B. The right venous angle.
- C. Place the formation of the inferior vena cava.
- D. Place the formation of the superior vena cava.
- E. Place formation Brachiocephalic vein.

4. Patient, 23 years old, was treated on the left breast inflammation (mastitis). Three weeks after treatment, the patient again appealed to the doctor complaining of unbearable pain in the left supraclavicular fossa. Survey Results – regional inflammation of lymph nodes. What are the lymph nodes most likely have been caught up in the inflammatory process?

- A. Supraclavicular.
- B. Lateral neck.
- C. Occipital.
- D. The front neck deep.

5. The patient, 23 years old, turned to the doctor complaining of swelling and pain in the side of the neck. The survey found physician superficial wound inflicted with a sharp object in the middle section of the right of subcutaneous muscle and inflammation of the anterior jugular and lateral deep cervical lymph nodes. Which lymphatic collector lymph flowing from the affected lymph nodes?

- A. The left jugular lymphatic trunk.
- B. Right jugular lymphatic trunk.
- C. Thoracic duct.
- D. Right subclavian trunk.
- E. The left subclavian trunk.

6. The victim, 47 years, due to an accident, was injured sternum. Asked the doctor a week later complaining of pain along the right edge of the sternum and fever. After the examination, the doctor found the right inflammation of lymph nodes. Which lymphatic collector lymph flowing from the affected lymph nodes?

- A. Right jugular lymphatic trunk.
- B. Thoracic duct.
- C. The left jugular lymphatic trunk.

- D. Right subclavian trunk.
- E. The left subclavian trunk.

7. Teenager 12 years, due to an accident damaged thoracic duct in place it adjacent to the dome of the pleura. What part of the thoracic duct injured?

- A. Arcus ductus thoracici.
- V. Pars cervicalis.
- S. Pars thoracici.
- D. Pars abdominalis.
- E. Cisterna chyli.

8. The doctor found in the pleural cavity adhesions connecting parietal pleura with the apical segment while damage arcus ductus thoracici. In which area are adhesions?

- A. Cupula pleurae.
- B. Recessus costodiaphragmaticus.
- C. Recessus costomediastinalis.
- D. Recessus phrenicomediastinalis.
- E. Recessus vertebromediastinalis.

11. After surgery for renal vein thrombosis of the left, the patient, 60 years old, complains of fever and swelling in the area of postoperative suture. The doctor showed inflammation of the lymph nodes. Which of lymph nodes involved in the process?

- A. Lumbar lymph nodes.
- B. Lower epigastric lymph nodes.
- C. Parietal lymph nodes of the abdomen.
- D. Pelvic lymph nodes.
- E. Pyloric lymph nodes.

12. The doctor asked man, 50 years old, complaining of redness, itching, peeling skin on the head of the penis. The examination revealed enlarged lymph nodes. In that goes lymph nodes of the penis?

- A. Sacral lymph nodes.
- B. Lower epigastric lymph nodes.
- C. Lumbar lymph nodes.
- D. External iliac lymph nodes.
- E. Parietal lymph nodes of the abdomen.

13. In the urological department Hospital enrolled patients diagnosed with

adenoma (benign tumor) of the prostate. The examination revealed enlarged lymph nodes. In which lymph nodes lymph directed primarily against prostate cancer?

- A. External iliac lymph nodes.
- B. Lower epigastric lymph nodes.
- C. Lumbar lymph nodes.
- D. Sacral lymph nodes.
- E. Parietal lymph nodes of the abdomen.

14. An examination of a patient complaining of frequent respiratory diseases, permanent weakness, the doctor suspected damage to the immune system. A detailed examination of the patient made it possible diagnosis - AIDS. When the disease affects the organs that produce cells that provide cellular and humoral immunity - T lymphocytes and B lymphocytes. What is the body?

- A. Tonsils.
- B. Spleen.
- C. Bone marrow.
- D. Area lymph nodes.
- E. Arteria area lymph nodes.

15. The patient - a malignant tumor of lower lobe of the left lung. Objectively: revealed congestion in the lungs wheezing, complete stupidity left. Where lymph flowing from the lower lobe of the left lung?

- A. Truncus lymphaticus dexster.
- B. Truncus lumbalis sinister.
- C. Truncus bronchomedsostinalis sinister.
- D. Ductus thoracicus.
- E. Truncus subclavius.