

Bogomolets National Medical University

Department of Human Anatomy

GUIDELINES

<i>Academic discipline</i>	Human anatomy
<i>Module №</i>	2
<i>Study subject</i>	Spinal nerves. Cervical plexus.
<i>Number of hours</i>	3

1. Relevance of the topic:

The structures of the peripheral nervous system (roots of spinal nerves, sensory nodes, trunks and branches of spinal nerves, areas of peripheral and segmental innervation of the skin plexus of anterior branches of spinal nerves, particularly Cervical plexus and its branches - is the base of clinical thinking in terms of differential diagnosis for the doctor of any specialty, but above all a neurologist, vertebroneurologist, traumatologist, dermatologist, general practitioner.

2. Specific objectives of practical lesson

- Analyze the composition of fibers of anterior and posterior roots of spinal nerves.
- Explain the formation of spinal nerve.
- Suggest the definition of spinal nerve.
- Classify spinal nerve branches.
- Explain functional anatomy of thoracic spinal nerve branches.
- Define term "plexus of somatic nerves" including the formation of cervical plexus.
- Draw a scheme of spinal nerve:
 - a - in cervical region of spinal cord (except for the C VIII) ;
 - b - in thoracic region of spinal cord;
 - c - on the level of SII – SIV.
- Analyze the connection of somatic nerve (thoracic spinal nerve) with nodes of sympathetic trunk.
- Create the conception of gray and white connecting branches in the functional aspect.

3. Basic level of preparation (interdisciplinary integration) of the student includes in itself knowledge of medical biology and histology of the development of nervous system in phylogenesis and ontogenesis.

Name of previous disciplines	Obtained skills
1. Medical Biology and Histology	Know ontogenesis and phylogenesis of nervous system. Histological structure of the neuron
2. Sections of Human Anatomy:	
- osteology - miology	The student should have skills to describe the structure of the spine in general, to be able to demonstrate on preparation structural features of the cervical vertebrae, their connections with each other and with the bones of the skull. The student should also learn skills in order to describe the muscles of the neck, chest, back, abdomen and be able to demonstrate them on preparation.
- central nervous system	Identify and demonstrate on preparation departments of cerebrum and spinal cord and their cavities. Describe the external and internal structure of the spinal cord.

For practical lesson "Spinal nerves. Cervical plexus " a student should know and be able to:

3.1. Basic level of preparation (baseline of knowledge and skills)

- Know the anatomy of the vertebrae and their local structural features.
- To be able to display all the anatomical structures of the spine in general.
- Classify the muscles of the neck, trunk, characterize the diaphragm.
- Find mediastinal departments and a list of organs in each of them.
- Describe and demonstrate nucleus of gray matter of the spinal cord in the functional highlights on the schemes .
- Know the placing of segments of the spinal cord, the so-called rule of Shipo.
- Determine the morphological basis of reflex arc, that is closed through the spinal cord.
- Know types of receptors and varieties receptor sensitivity.
- Determine the structure of the spinal cord segments and segments skeletopy of different departments. Explain the Shipo rule.
- Identify and demonstrate on the preparations spinal cord and brain furrows, places of entry and exit of roots, sensitive nodes of spinal and cranial nerves.
- Determine the overall functional characteristics of neurons of posterior, lateral and anterior horns, name the nucleus of horns and determine their individual function.
- Determine the overall functional characteristics of anterior, lateral and posterior ropes of spinal cord, name the ways they contain.
- Compare and draw the peripheral innervation of the skin of the trunk with different colors on schemes in guide.

4. Tasks for independent work during preparation for the classes.

4.1. The list of key terms, parameters, characteristics which the student have to assimilate while preparing for lesson

Term	Definition
Spinal nerve ganglion spinale anterior root posterior root nuclei parasymphatici sacrales S ₂ -S ₄ rr. communicantes grisei funiculus n. spinalis). r. posterior; r. anterior; r. meningeus; <i>n. occipitalis minor</i> <i>n. auricularis magnus</i> <i>rr. anterior et posterior</i> <i>n. auricularis magnus</i> <i>n. transverses col</i> <i>ansa cervicalis superficialis</i> <i>nn. supraclaviculares medialis,</i> <i>intermedius et lateralis)</i> n. phrenicus	

4.2. Control questions for practical lesson "Spinal nerves, cervical plexus"

Questions to control the entry level of students' knowledge

1. What from the spinal node is formed?
2. What posterior spinal nerve root is? Its functional characteristics. What the front root of spinal nerve is formed from ?
3. Variations of anterior spinal nerve root.
4. What sensitivity conducts back root of spinal nerve?
5. Where the spinal node and spinal nerve roots are placed?
6. Embryological classification of muscles of the neck, back, chest, abdomen.
7. Define spinal nerve and name the topographical departments of spinal nerves
8. Name branches of spinal nerves.
9. Identification and classification of branches of the cervical plexus.
10. Name the anatomical formation of anterior branches of spinal nerves.
11. What is the upper and lower cervical spine loops. Show hypoglossal nerve and cervical loop.
12. Demonstrate the phrenic nerve.

Questions to control the final level of preparation

1. Describe the fiber composition of spinal nerve in functional aspect.
2. Name the general features of back branches of spinal nerves.
3. Characteristics of back branches I and II cervical spinal nerves.
4. Describe the skin and muscle branches of back branches of spinal nerves and radicular zone.
5. Characteristics, topography and branches of intercostal nerves, subcostal nerve .
6. Describe cutaneous branches of intercostal nerves, humero-intercostal nerves.
7. Describe the muscular branches of intercostal nerves. Pleural and peritoneal branches.
8. What Cervical plexus is formed from?
9. Topography and classification of branches of the cervical plexus in the functional coverage.
10. Name and show cutaneous branches of the cervical plexus.
11. Name muscular branches of the cervical plexus. What muscle groups the innervate?
12. Demonstrate and describe the neck loop and muscles that it innervates.
13. Demonstrate and describe the phrenic nerve (right and left).
14. In which visceral plexuses phrenic nerve is present?
15. Anatomical substantiation of presence of the phrenicus-symptom (+) due to liver diseases.
16. What is superficial neck loop is formed by?
17. Explain the phenomenon of skin sensitivity disorders (in areas Zakharyin-Ged) in diseases of the viscera.

18. Explain the difference between peripheral (zonal) and segment (radicular) innervation of the skin

Practical tasks:

- Dissect hypoglossal nerve and the neck loop.
- Dissect cutaneous branches of the cervical plexus.
- Dissect right and left diaphragm nerves.
- Work out the different color schemes and designs for appropriate topics in the manual control for independent work of students.

4.3. The content of the topic.

The spinal nerves C1 – C4 form the basis of the cervical plexus.

At each vertebral level, paired spinal nerves leave the spinal cord via the **intervertebral foramina** of the vertebral column.

Each nerve then divides into anterior and posterior nerve fibres. The cervical plexus begins as the **anterior fibres** of the spinal nerves C1, C2, C3 and C4.

These fibres combine with each other to form the branches of the cervical plexus.

The cervical plexus gives rise to numerous branches which supply structures in the head and neck. They can broadly be divided into two groups – muscular branches and sensory branches.

We shall now examine these branches in more detail.

The muscular branches of the cervical plexus are located deep to the sensory branches. They supply some of the muscles of the neck, back and the diaphragm.

After arising from the cervical plexus, the muscular branches tend to travel initially in an anteromedial direction. This is in contrast to the cutaneous branches, which travel posteriorly.

Phrenic Nerve

The phrenic nerve arises from the anterior rami of C3-C5. It provides motor innervation to the **diaphragm**.

After arising from the cervical plexus, the nerve travels down the surface of the **anterior scalene** muscle, and enters the thorax. In the thoracic cavity, the nerve descends anteriorly to the root of the lung to reach the diaphragm.

A good memory aid for the roots of the phrenic nerve is C3,4,5 keeps the diaphragm alive.

Nerves to Geniohyoid and Thyrohyoid

The C1 spinal nerve gives rise to nerves to the **geniohyoid** (moves the hyoid bone anteriorly and upwards, expanding the airway) and the **thyrohyoid** (which depresses the hyoid bone and elevates the larynx).

These nerves travel with the **hypoglossal nerve** to reach their respective muscles.

Ansa Cervicalis

The ansa cervicalis (goose's neck) is a loop of nerves, formed by nerve roots C1-C3. It gives off four muscular branches:

- Superior belly of the omohyoid muscle
- Inferior belly of omohyoid muscle
- Sternohyoid
- Sternothyroid

These muscles (the infrahyoids) act to depress the hyoid bone; an important function for swallowing and speech.

Other Muscular Branches

Several other minor branches arise from the nerve roots to supply muscles of the neck and back:

- **C1-C2:** Rectus capitis anterior and lateralis
- **C1-C3:** Longus capitis
- **C2-C3:** Prevertebral muscles and sternocleidomastoid
- **C3-C4:** Levator scapulae, trapezius and scalenus medius

The middle and anterior scalenus muscles also receive innervation directly from the cervical plexus.

The cutaneous branches of the cervical plexus supply the skin of the neck, upper thorax, scalp and ear. These nerves all enter the skin at the middle of the posterior border of the sternocleidomastoid. This area is known as the nerve point of the neck (Erb's point), and is utilised when performing a cervical plexus nerve block.

Greater Auricular Nerve

The greater auricular nerve is formed by fibres from C2 and C3 roots. It provides sensation to the **external ear** and the skin over the **parotid gland**. It is the largest ascending branch of the plexus.

The nerve also communicates with the **auricular branch of the vagus nerve** and the **posterior auricular branch of the facial nerve** (which innervates some small muscles around the ear).

Transverse Cervical Nerve

The transverse cervical nerve is also formed by fibres from C2 and C3. It curves around the posterior aspect of the sternocleidomastoid, and supplies sensation to the anterior neck. The nerve then pierces the **deep cervical fascia** and then gives branches that pass superiorly and inferiorly to supply the anterolateral skin of the neck and upper sternum.

Lesser Occipital Nerve

The lesser occipital nerve is derived solely from the C2 root. It supplies cutaneous sensation to the **posterosuperior scalp**, and commonly communicates with the posterior branch of the greater auricular nerve.

After its formation, the nerve curves around the accessory nerve, and passes superiorly, close to the posterior border of the sternocleidomastoid.

Supraclavicular Nerves

The supraclavicular nerves are a group of nerves formed from the C3 and C4 roots.

They arise from the behind the posterior border of sternocleidomastoid, and provide sensation to the skin overlying the **suprascapular fossa** and upper thoracic region and sternoclavicular joint.

Additions.

Means for control:

- tests format A (KPOK-1)
- practical tasks concerning illustrations in educational methodical manual "Human Anatomy (self-control training students for practical training)"
- control questions:
 - a) entry level of students' knowledge,
 - b) the final level of students' knowledge,

Literature:

Informational resources

www.anatom.ua

<http://nmu.ua/zagalni-vidomosti/kafedri/kafedra-anatomyy-cheloveka/informatsiya-dlya-studentiv-6/>

Base:

1. Human anatomy: book in 3 volumes / A. S. Holovatsky, V.G.Cherkasov, N. G. Sapin [et al.] – Ed. 3-rd edition, modified – Vinnitsa: Nova knyga, 2015. – T. 3.
2. Sviridov, O. I. Human Anatomy / Sviridov O. I. – Kyiv: High school, 2000.

Additional:

1. Tests "KROK-1" - human anatomy: textbook / under the editorship of V. G. Cherkasova, I. V. Dzevulska, O.I. Kovalchuk. 5-th Edition, revised.
2. Human anatomy: in 3 volumes / ed. by V. G. Koveshnikov. – Lugansk: Virtual reality, 2008. – T. 3.
3. Netter F. Atlas of human anatomy / F. Netter; [transl. from eng. A. A. Tsegelsky]; ed. by U.B. Tchaikovsky. – Lviv: Nautilus, 2004.
4. International anatomical nomenclature. Ukrainian standard / edited by I. I. Bobryk, V. G. Koveshnikov. - Kiev: Health, 2001.

Tests:

- 1. Which branches of the cervical plexus are found most superficially?**
 - A. Muscular branches
 - B. Sensory branches
 - C. Both are in the same plane
 - D. Another fibre type

- 2. Where do the sensory branches of the cervical plexus enter the skin?**
 - A. Middle of the anterior border of sternocleidomastoid
 - B. Middle of the posterior border of sternocleidomastoid
 - C. Middle of the superior border of the clavicle
 - D. At the insertion of the trapezius muscle

- 3. Which is the largest ascending branch of the cervical plexus, which provides sensation to the external ear?**
 - A. Transverse cervical nerve
 - B. Greater auricular nerve
 - C. Lesser occipital nerve
 - D. Supraclavicular nerve

- 4. Which region of the scalp does the lesser occipital nerve give cutaneous supply to?**
 - A. Posterosuperior
 - B. Posteromedial
 - C. Anteromedial
 - D. Anteriolateral

- 5. The cervical plexus is made up of the anterior rami of which spinal nerves?**
 - A. C1-C3
 - B. C1-C4
 - C. C2-C4
 - D. C1-C6

- 6. Which of the following is not a ganglion within the sympathetic chain?**
 - A. Otic ganglion
 - B. Superior cervical ganglion
 - C. Middle cervical ganglion
 - D. Inferior cervical ganglion

- 7. Which artery does the internal carotid nerve hitchhike along?**
 - A. Common carotid artery
 - B. Internal carotid artery
 - C. External carotid artery
 - D. Inferior thyroid artery

- 8. What does the external carotid nerve innervate?**

- A. Structures in the eye
- B. Pharynx
- C. Larynx
- D. External carotid artery.

9. Which of the following does not receive innervation from the thyroid branches of the middle cervical ganglion?

- A. Larynx
- B. Cardiac plexus
- C. Trachea
- D. Pharynx

10. Which of the following does the inferior cardiac nerve supply?

- A. Larynx
- B. Pharynx
- C. Cardiac plexus
- D. Upper oesophagus.