N. N. Burdenko Voronezh state medical University.
Department of human anatomy

«Утверждаю»
Зав. кафедрой нормальной
анатомии человека,
проф. Н. Т. Алексеева
31.08.2019 г.

GUIDELINES FOR STUDENTS ON THE TOPIC OF THE PRACTICAL LESSON:

" Spinal cord: external and internal structure, functions. Spinal segments. Covers of the brain and spinal cord"

Specialty general medicine

Course I

Theme of the lesson: “Spinal cord: external and internal structure, functions. Spinal segments. Covers of the brain and spinal cord

The purpose of the lesson:
● study the external and internal structure of the spinal cord, taking into account the functional affiliation of its constituent parts;
● learn to explain using Latin terminology and demonstrate on natural preparations details of the structure of the membranes of the spinal cord and brain;
● have an idea of the places of synthesis and utilization of cerebrospinal fluid, as well as liquorodynamics.
Motivation for the topic of the lesson: the formation of knowledge about the structure and functioning of the central nervous system as a whole and its departments is necessary for studying the following sections of anatomy, histology, normal physiology, topographic anatomy, pharmacology, pathological anatomy, pathological physiology, and is the basis for studying clinical disciplines: neurology , psychiatry and neurosurgery.

Competencies: DIC 1, 9.

Test questions on the topic of the lesson (App 1)
Lesson plan
1. Testing the assimilation of knowledge obtained in the previous lesson: test control, oral questioning, testing of practical skills.
2. Conversation on the topic of the lesson.
3. Performing assignments.
3.1. Independent classroom work of students.

On the preparation of the spinal cord with its membranes and on individual preparations, consider the structure of the spinal cord. Consider the shape, length, and thickenings of the spinal cord — the cervical and lumbosacral, the anterior and posterior roots, the spinal node, the spinal nerve, the cerebral cone, and the terminal thread.
On the preparation of the cross section of the spinal cord, be able to distinguish between gray and white matter, the front, side and back horns of the gray matter, the central channel, the front, back and side cords, their own bundles of cords. Also distinguish the anterior median fissure, the posterior median groove, the anterior and posterior lateral grooves, the posterior median groove. Next, the teacher on the diagram to consider the structure of the somatic three-neural reflex arc, to determine the localization of neurocytes: the body of the 1st neuron (sensitive) - spinal ganglia, the 2nd (insertion) - back horns, 3rd (motor) - front horns. Determine the boundaries of the spinal cord segment on individual drugs and on the preparation of the spinal cord in the spinal canal.
To study the alphanumeric designation of segments (similar to vertebrae), to note the presence of eight cervical segments and, respectively, eight cervical spinal nerves, the mismatch of the location of segments in relation to the vertebrae at the level of which they were laid during development (the brain cone reaches the 3rd lumbar vertebra in the newborn and 2nd lumbar - in an adult).

Skeletonotopy of spinal cord segments

Segments	Vertebrae
Top four cervical	Conform to CI-IV.
Lower cervical and upper thoracic	1 vertebra above
Medium pectoral	Located 2 vertebrae higher

Lower thoracic	Located above 3 vertebrae
Lumbar	Located at ThX, XI
Sacral and coccygeal	Located at the level of ThXII, LI, II.

Remember that due to the mismatch between the length of the spinal cord and the length of the spinal canal, the roots of the spinal nerves of the lower segments are directed to the intervertebral openings, where the spinal nerve is formed, forming an “equine tail” at an angle (cauda equina). When depicting the internal structure of the spinal cord in a diagram, it is necessary to highlight the location of gray matter in the form of the letter “H” - in the presence of front and rear horns - segments CI-VIII and LIII-CoIII - and in the form of a “butterfly” - in the presence of front, rear and side horns (segments from ThI to LII). Consider the lateral horns, which are formed mainly by neurocytes related to the autonomic nervous system

Then study the topography of the nuclei of the gray matter of the spinal cord, focusing on the fact that the nuclei of the anterior horn (antero- and posterior medial, antero- and posterolateral and central) contain motor neurons (motor neurons), the nuclei of the horn are inserted (associative), and in the nuclei of the lateral horn (nuclei intermediolaterales) are the centers of the sympathetic division of the autonomic nervous system.

The membranes of the spinal cord are examined on the preparation of the spinal cord located in the spinal canal, where the epidural space containing the internal vertebral venous plexus and fiber, as well as the membranes of the spinal nerves fused with the periosteum in the intervertebral openings, are indicated. The hard, arachnoid and vascular membranes are studied on separate preparations of the spinal cord (extracted from the spinal canal), where subdural and subarachnoid spaces can also be distinguished. The importance of the subarachnoid space is noted, along which cerebrospinal fluid circulates, focusing on its expanded part below the second lumbar vertebra, where only the roots of the spinal nerves are located (“horse tail”) and puncture can be performed (usually between the spinous processes of the III and IV lumbar vertebrae) in order to obtain cerebrospinal fluid. The role of the dentate ligament and posterior septum as anatomical formations that fix the spinal cord in its membranes is also noted. At the end, attention is paid to the function of the spinal cord, its more primitive segmental structure is taken into account, compared with the brain. It is advisable to repeat the function of the cerebral hemispheres.

The study of the structure of the Covers of the brain is advisable to carry out during the preparation of the whole brain during the lesson, together with the teacher. Dura mater is studied on a special preparation of the skull with preserved dura mater. Using this drug, the duplicates, processes and sinuses of the dura mater are studied, their structural features that distinguish them from veins are indicated; features of the message of the sines with each other. Attention is drawn to the relationship of the sinuses with the bones of the arch and base of the skull. To explain the internal structure of the sinus of the dura mater, a longitudinal and transverse section of the upper longitudinal sinus is used, as well as its diagram. Then, the sinuses of the dura mater are examined. The transverse, sigmoid, straight, superior and inferior sagittal, occipital sinuses are studied. Attention is drawn to the cavernous sinuses, their transverse anastomoses, the complexity of their structure, to the connection with the veins of the orbit, and through them with the facial veins, which is important in the spread of infection. Shows subdural space.

The arachnoid membrane, pachyon granulations, expansion of the subarachnoid space are examined on the whole preparation of the brain with preserved soft and arachnoid membrane. Then, significant differences in the membranes of the brain from the spinal cord are examined. Attention is drawn to the expansion of the subarachnoid space (cistern), which are especially well expressed on the lower surface of the brain. The cerebellar-cerebral cistern, the cistern of the lateral fossa of the cerebrum, the intersternal cistern, the cistern of intersection are being studied. Granulation of the arachnoid membrane, as well as dimples formed on their impact on the adjacent parts of the inner surface of the skull are considered.

The list of anatomical formations that a student should be able to find and demonstrate on natural preparations

hard shell	Dura mater encephali
sickle of the brain	Falx cerebri
cerebellum	Tentorium cerebelli
cerebellum sickle	Falx cerebelli
diaphragm saddles	Diaphragma sellae
subdural space	Spatium subdurale
arachnoid	Arachnoidea encephali
cerebellar tank	Cisterna cerebellomedullaris
cerebral lateral fossa cistern	Cisterna fossae lateralis cerebri
cross tank	Cisterna chiasmatis
intersternal tank	Cisterna interpeduncularis
arachnoid granulation	Granulationes arachnoidales
soft membrane of the spinal cord	Pia mater spinalis
gear ligament	Ligamentum denticulatum
vascular base of the fourth ventricle	Tela choroidea ventriculi quarti
vascular plexus of the fourth ventricle	Plexus choroideus ventriculi quarti
vascular base of the third ventricle	Tela choroidea ventriculi tertii
plexus of the third ventricle	Plexus choroideus ventriculi tertii
plexus of the lateral ventricle	Plexus choroideus ventriculi lateralis
middle aperture of the fourth ventricle	Apertura mediana ventriculi quarti
lateral aperture of the fourth ventricle	Apertura lateralis ventriculi quarti
front median fissure	Fissura mediana anterior
lateral cord	Funiculus lateralis
wedge-shaped bundle	Fasciculus cuneatus
wedge-shaped tubercle	Tuberculum cuneatum
thin beam	Fasciculus gracilis
tubercle of the thin nucleus	Tuberculum gracile
posterior median sulcus	Sulcus medianus posterior
cavernous sinus	Sinus cavernosus
sigmoid sinus	Sinus sigmoideus
transverse sine	Sinus transversus

3.2. Monitoring knowledge gained in this lesson (App 2).

3.3. The solution of situational problems.
1. In a patient after an infectious disease, an inflammatory process is established in the subpatine space of the brain. How is it possible for infected cerebrospinal fluid to enter from the subarachnoid space into the ventricular cavity?
2. Indicate at what level should spinal puncture be performed?

4. Assignment for the next lesson. Topic: “Spinal cord: external and internal structure, functions. Spinal segments. Covers of the brain and spinal cord

Annex 1
Test questions on the topic of the lesson
1. Name and show the membranes of the spinal cord and brain?
2. Where is cerebrospinal fluid produced?

3. Through which holes does cerebrospinal fluid enter from the cavity of the IV ventricle into the subarachnoid space?
4. Where does cerebrospinal fluid flow from the subarachnoid space?
5. Through which openings does the third ventricle communicate with the lateral ventricles?
6. Through which anatomical formation does the third ventricle communicate with the fourth ventricle?
7. Between which vertebrae is a puncture performed for taking cerebrospinal fluid in an adult?
8. Between which vertebrae is a puncture performed for taking cerebrospinal fluid in a child?
9. Name and show the membranes of the spinal cord and brain.
10. In which intershell space is cerebrospinal fluid located?
11. What is the name of the expansion of the subarachnoid space of the spinal cord and at the level of which vertebrae is it located?
12. What are the intershell spaces of the spinal cord, determine their contents?
13. What are the intershell spaces of the brain, determine their contents?
14. Determine the functional value of the cerebrospinal fluid?
15. Name and show the expansion of the subarachnoid space of the brain?
16.Define the functional significance of pachyon granulation?
17. Name and show the processes of the dura mater of the brain?
18. Name and show the sinuses of the dura mater?
19. What is in the sinuses of the dura mater?

App 2

The list of questions for the test control of knowledge gained in the current lesson

1. What are the thickenings of the spinal cord?
2. What anatomical structures are located on the surface of the spinal cord?
3. Where are the sacral segments located in the spinal canal?
4. Where are the coccygeal segments located in the spinal canal?
5. What anatomical structures belong to the white matter of the spinal cord?
6. What anatomical structures are located in the epidural space of the spinal canal?
7. What structures secrete cerebrospinal fluid?
8. How many pairs of spinal nerves are distinguished?
9. What openings connect the cavity of the fourth ventricle and the subarachnoid space?
10. Where are the subarachnoid cisterns located on the basal surface of the brain?
11. What are the formed spinal nodes?
12. What is the outer shell of the brain?
13. What is the border between the spinal cord and the medulla oblongata?
14. What is the gray matter of the spinal cord formed?
15. What arteries do the spinal cord supply?
16. What cranial nerves partially extend from the spinal cord?
17. What education provides the outflow of cerebrospinal fluid from the subarachnoid space into the venous sinuses?
18. At what level is the lower border of the spinal cord?
19. Name and show the sinuses of the dura mater?
20. What are sensory nerves?
21. List the thickenings of the spinal cord?
22. What comes out of the anterior lateral groove of the spinal cord?
23. What is the outer shell of the brain?
24. What is between the dura mater of the spinal cord and the periosteum of the spinal canal?
25. Where is the intersternal cistern located?
26. How does cerebrospinal fluid flow into the subarachnoid space?
27. What anatomical structures are located on the surface of the spinal cord?

28. What is located in the epidural space of the spinal canal?
29. Which cranial nerves partially extend from the spinal cord?
30. What arteries do the spinal cord supply?
31. How are the fourth ventricular cavity and subarachnoid space connected?
32. At what level is the lower border of the spinal cord located?
33. Where are the sacral segments located in the spinal canal?
34. What is located in the front horns of the spinal cord?
35. What is the secretion of cerebrospinal fluid?
36. Which vertebrae are the lower border of the spinal cord in an adult?
37. Which grooves of the spinal cord are the exit sites of the posterior roots of the spinal nerves?
38. Which grooves of the spinal cord are the exit sites of the anterior roots of the spinal nerves?
39. What is located in the posterior horns of the spinal cord?
40. What is located in the lateral horns of the spinal cord?
41. Where is the body of the second (insertion) neuron of the reflex arc located?
42. Where is the anterolateral nucleus of the spinal cord located?
43. Where is the gelatinous substance of the spinal cord located?
44. What is located in the front horns of the spinal cord?
45. What is located in the spinal nodes?
46. Where is the first (receptor, afferent) neuron of the reflex arc localized?
47. Where is the third neuron (motor, efferent) of the reflex arc located?
48. Where is the anteromedial nucleus of the spinal cord located?
49. Where is the thoracic spinal cord located?
50. Where is the central core of the spinal cord located?
51. What is between the dura mater of the spinal cord and the periosteum of the spinal canal?
52. Where is the lateral cistern located?
53. Where are the coccygeal segments located in the spinal canal?
54. What is the white matter of the spinal cord?
55. What is in the epidural space of the spinal canal?
56. What is the function of cerebrospinal fluid?
57. What is located in the posterior horns of the spinal cord?
58. What is located in the lateral horns of the spinal cord?
59. Where is the second (insertion) neuron of the reflex arc located?
60. What are sensory nerves?
61. What comes out of the anterior lateral groove of the spinal cord?
62. Where is the anterolateral nucleus of the spinal cord located?
63. Where is the gelatinous substance of the spinal cord located?
64. What is the outer shell of the brain?
65. Through which openings does cerebrospinal fluid enter from the cavity of the fourth ventricle into the subarachnoid space?
66. Through which openings does the third ventricle communicate with the lateral ventricles?
67. Through what anatomical formation does the III ventricle communicate with the IV ventricle?
68. Between which vertebrae is a puncture performed to take cerebrospinal fluid from an adult?
69. Between which vertebrae is a puncture performed for taking cerebrospinal fluid in a child?
70. In what intershell space is cerebrospinal fluid?
71. What is the name of the expansion of the subarachnoid space of the spinal cord and at the level of which vertebrae is it located?
72. What are the intershell spaces of the spinal cord, determine their contents?
73. What are the extensions of the subarachnoid space of the brain?
74. What are the processes of the dura mater of the brain?
75. What is in the sinuses of the dura mater?