

Bogomolets National Medical University

Department of human anatomy

GUIDELINES

<i>Academic Subject Matter</i>	HUMAN ANATOMY
Module №	2
Content module №	11
Theme of the lesson	The meninges of spinal cord and brain. The formation and ways of cerebrospinal fluid circulation.
Faculty	Medical1,2,3,4, military
Amount of hours	3

2017

1. Relevance of the topic:

The meninges are three layers of connective tissue membranes that surround the brain and spinal cord. The outermost membrane of the meninges is called the dura mater. It is a thick and tough membrane and contains channels for blood to come into the brain tissue. The one, closest to the brain and spinal cord, is called the pia mater. It is made of delicate ("pia") connective tissue with a rich supply of blood vessels. The finest middle meninges is called the arachnoid membrane. The cerebrospinal fluid is renewed every 4 -7 hours and from blood plasma has a low protein content and high concentration of sodium, potassium and chlorine. Knowledge of the topography, structure of all parts of the brain will help in determining the correct diagnosis of the patient, since damage of the brain there are severe disorders with loss of different kinds of sensitivity, motor responses. It will help to prevent inflammation and traumatic brain injury.

2. Specific objectives:

To determine the function of the meninges and spinal cord contents meningeal spaces and their importance in the practice of medicine. To determine the function of the meninges and spinal cord contents spatium meningeum and their importance in the practice of medicine.

To demonstrate on the preparation of spatium meningeum of the brain and spinal cord.

To explain the formation and circulation of cerebrospinal fluid and its function.

To determine the structural features of the dura mater.

To demonstrate on preparation the growths of dura mater of the brain and their topography.

The dura mater sinuses of the brain and their functional significance.

Spatia meningis of the cerebrum and their contents. The formation and ways of cerebrospinal fluid circulation.

3. Basic training level of the student includes knowledge of medical biology regularities of phylogenesis of the brain and spinal cord; to know the structural features of meninges of the brain higher mammals; The student should have the skills of description the structure of the cerebral skull's bones, the location of the furrows of dura mater sinuses of the brain.

4. Tasks for self-control during preparation to practical classes.

4.1. A list of the main terms, parameters, characteristics that need to learn by the student during the preparation for the lesson.

Term	Definition
The cerebrospinal fluid	The biological environment of the body, circulating in the ventricles of the brain and subarachnoid space of the brain and spinal cord. Chemical composition similar to blood plasma.
The dura mater sinuses	Space inside is lined with endothelium, which circulates venous blood.
Tent of the cerebellum	Connective process of the Dura that separates the occipital lobes of the hemispheres from the cerebellum
Plexus choroideus ventriculi lateralis	Choroid plexus lateral ventricle

4.2. Theoretical questions to the lesson:

1. Give a name and show the meninges of the spinal cord.
2. List the spatia meningis of the spinal cord. What are they filled in?
3. What is formed by locking apparatus of the spinal cord?
5. Give a name and demonstrate the sinuses of the dura mater.
6. What is formed by the drain of the sinuses?
7. Feature of the subarachnoid space. Its tanks.
8. Determine the place of formation and ways of circulation the cerebrospinal fluid.
9. Where is the puncture to take the cerebrospinal fluid? Anatomical substantiation.
10. Give a name spatia meningis (cavity) of brain and spinal cord and determine what they filled in.
11. Show on preparation the growths of the dura mater.
12. What is the subarachnoid cavity and its collections?
13. List the sinuses of the dura mater, what are they formed by?
14. What delimit the growths of the dura mater?

4.3. The list of standardized practical skills:

The dura mater of the spinal cord

The pia mater of the spinal cord

The dura mater of the spinal cord

Falx cerebri

Falx cerebelli

Tent of the cerebellum

The diaphragm seat

Sinuses of the dura mater

Sinus sagittalis superior
Sinus sagittalis inferior
Sinus rectus
Sinus occipitalis
Sinus transversus
Confluens sinuum
Sinus sigmoideus
Sinus cavernosus
V-stone sinus
Sinus petrosus superior
Sinus petrosus inferior
The arachnoid meninges of the brain.
The pia meninges of the brain.

The content of the topic:

The meninges are three layers of protective tissue called the **dura mater**, **arachnoid mater**, and **pia mater** that surround the neuraxis. The meninges of the brain and spinal cord are continuous, being linked through the magnum foramen. The spinal cord and brain are surrounded by three membranes, the meninges.

Named from the outside inward they are:

Dura mater

Arachnoid mater

Pia mater

The Meninges of Spinal Cord:

Spinal dura mater

Spinal arachnoid mater

Spinal pia mater

Spinal Dura Mater

Characters

A dense, fibrous membrane that encloses the spinal cord and cauda equina

Above, attached to circumference of foramen magnum,

Below, becomes thinner at level of S2, invests filum terminale to attach at back of coccyx,

On each side, continuous with external membrane of spinal nerves at intervertebral foramina.

Epidural space

Position: lies between spinal dura mater and periosteum of vertebral canal

Contents: a quantity of loose connective tissue, fat, lymphatic vessels and vertebral venous plexus, the **spinal nerves** on each side pass through the epidural space which is applicable for block anesthesia, subdural space

Spinal Arachnoid Mater

Characters

A thin, delicate, tubular membran loosely investing spinal cord,

Above, it is continuous with cerebral arachnoid mater.

Subarachnoid Space

Position: lies between pia and arachnoid maters containing cerebrospinal fluid.

Terminal cistern: the largest part of subarachnoid space extending from termination of spinal cord to level of S2, where it is occupied by nerves of cauda equina, so it is the best site for a lumbar puncture .

Spinal Pia Mater

A delicate vascular membrane that closely invests the spinal cord.

Denticulate ligament: consist of 21 pairs triangular ligaments extending from spinal cord on each side between anterior and posterior roots of spinal nerves to spinal dura mate; these ligament Spinal Pia Maters help to fix position of spinal cord.

Filum terminale: an extension of pia beyond conus medullaris.

The Meninges of Brain

Cerebral dural mater

Cerebral arachnoid mater

Cerebral pia mater

Cerebral Dural Mater

Characters

A thick and dense inelastic membrane that composed of two layers, an inner or meningeal and outer or endosteal.

It is in loose contact with calvaria, and most strongly adherent to base of skull.

Cerebral dural mater

Four septa

Cerebral falx

Tentorium of cerebellum in front there is a gap, the tentorial incisure, for passage of midbrain.

Cerebellar falx

Diaphragma sellae

Sinuses of dura mater:

Superior sagittal sinus

Inferior sagittal sinus

Straight sinus

Confluence of sinus

Transverse sinus

Sigmoid sinus

Superior petrosal sinuses

inferior petrosal sinuses

Cavernous sinus

Position: lies on each side of sella turcica

Traversing the cavernous sinus

Internal carotid artery

Abducent nerve

Traversing the lateral wall of the cavernous sinus:

Oculomotor nerve

Trochlear nerve

Ophthalmic nerve

Maxillary nerve

Cerebral Arachnoid Mater

Characters: a delicate membrane covering brain loosely, passing over sulci and entering only cerebral longitudinal and transverse fissures.

Arachnoid granulations - project into sinuses of dura mater, serve as sites where cerebrospinal fluid diffuses into bloodstream.

Cerebral Pia Mater

Closely invests brain surface,

In some areas the pia invaginates into ventricles to take part in the formation of choroids plexus .

Circulation of Cerebrospinal Fluid (CSF)

Cerebrospinal fluid is a clear colorless fluid;

Nourishes brain;

Removes waste;

Conducts chemical signals between parts of CNS;

Liquid cushion for brain and spinal cord.

Production: produced by the choroids plexuses within the lateral, third and fourth ventricles.

Materials for self-control:

1. Patient N., 41, was admitted to infectious diseases ward of the hospital with a high fever. Objectively: marked meningeal symptoms. Conducted a spinal tap. What anatomical formation was punctured?

A. Spatium subarachnoideum.

B. Spatium subdurale.

C. Spatium epidurale.

D. Cavum trigeminale.

E. Cisterna cerebellomedullaris.

2. The patient, 45 years old, with suspected inflammation of the meninges had to get spinal fluid. Diagnostic puncture is made between arcs of the lumbar vertebrae (L3-L4). Through which the bundle must penetrate the needle

puncture?

- A. Lig. iliolumbale.
- B. Lig. flavus.
- C. Lig. longitudinale anterius.
- D. Lig. longitudinale posterius.
- E. Lig. Intertransversarius.

3. With the aim of meningitis differential diagnostics are conducting a study of cerebrospinal fluid. In what place is the lumbar puncture safe?

- A. Th XII — L I.
- B. L II — L III.
- C. L I — L II.
- D. L III — L IV.
- E. S II — S IV.

4. The patient performed a spinal tap between 3-4 lumbar vertebrae. What purpose do you choose this place for the manipulation?

- A. To avoid damage to ganglion sensoria (spinale).
- B. To avoid damage to filum terminale.
- C. To get to the canalis centralis.
- D. To avoid damage to intumescentia lumbosacralis.
- E. To get into the subarachnoid space.

5. Patient N., 41 years old, got into no infections Department of the hospital with a high fever. Objectively: marked meningeal symptoms. Conducted a spinal tap. What anatomical formation was punctured?

- A. Spatium subarachnoideum.
- B. Spatium subdurale.
- C. Spatium epidurale.
- D. Cavum trigeminale.
- E. Cisterna cerebellomedullaris.

6. Patient N., 41, was admitted to infectious diseases ward of the hospital with a high fever. Objectively: marked meningeal symptoms. Conducted a spinal tap. What anatomical formation was punctured?

- A. Spatium subarachnoideum.
- B. Spatium subdurale.
- C. Spatium epidurale.
- D. Cavum trigeminale.
- E. Cisterna cerebellomedullaris.

7. The patient diagnosed – inflammation of the middle meninges of the spinal cord. Which meninges are damaged?

- A. Pia mater spinalis.
- B. Dura mater spinalis.

- C. Aracnoidea spinalis.
- D. Tunica serosa.
- E. Tunica adventicia.

8. The boy, 16 years old, at the time of the accident was damaged spine. Examination by the neurologist revealed that he does not have the tactile sensitivity on the left side of the body, although the damage observed on the right. Damage of what conductive path could cause this?

- A. Fasciculus cuneatus (Burdakh), fasciculus gracilis (Gaulle).
- B. Tr. spinothalamicus anterior to the right.
- C. Tr. spinothalamicus anterior to the left.
- D. Tr. rubrospinalis to the left.
- E. Tr. corticonuclearis to the right.

10. Patient S., 32 years old, delivered to a reception hall hospital with a stab wound of the back. After examination established the presence of a foreign body in the spinal cord at the level Th IX-LII segments. What nuclei are located on this level in the lateral horns of the spinal cord ?

- A. Nucl. thoracicus.
- B. Nucl. intermediolateralis.
- C. Nucl. parasympathicus sacrales.
- D. Nuclei proprii.
- E. Substantia gelatinosa

Keys to the tests:

1	2	3	4	5	6	7	8	10
D	C	A	D	D	A	E	E	D