What are the Meninges and Cerebrospinal Fluid?

Worksheet

The meninges are the dura mater (outer, tough layer), arachnoid mater (middle, web-like layer), and pia mater (inner layer hugging the brain surface); cerebrospinal fluid fills the subarachnoid space between the arachnoid and pia, cushioning and nourishing the brain and spinal cord.

Questions

1. Which meningeal layer is the toughest and closest to the skull?

A) Pia mater
B) Arachnoid mater
C) Dura mater
D) Subarachnoid layer

2. Where is cerebrospinal fluid mainly produced?

A) Subarachnoid space
B) Choroid plexus
C) Pia mater
D) Dural sinuses

3. In which space does cerebrospinal fluid circulate around the brain?

A) Epidural space
B) Subdural space
C) Subarachnoid space
D) Central canal only

4. How is excess CSF returned to the blood?

A) Through the choroid plexus
B) Through arachnoid granulations into venous sinuses
C) Through the spinal nerve roots
D) Through the pia mater directly into arteries

5. A patient suffers a head injury causing bleeding between the skull and the dura mater. What is this condition called and why is it dangerous?

6. A doctor performs a lumbar puncture (spinal tap) to sample cerebrospinal fluid. Which meningeal space is being accessed, and why is the lumbar region chosen?

7. A blockage forms in the cerebral aqueduct, preventing CSF from flowing from the third to the fourth ventricle. What condition can result?

8. Define: What are the three layers of the meninges, from outermost to innermost?

9. Define: Where is cerebrospinal fluid produced?

10. Define: Where does CSF circulate around the brain and spinal cord?

Answer Key

1. C) Dura mater - The dura mater is the outermost, thickest, and toughest of the three meningeal layers.

2. B) Choroid plexus - The choroid plexus, located in the brain's ventricles, produces most of the CSF.

3. C) Subarachnoid space - CSF fills the subarachnoid space, located between the arachnoid mater and pia mater.

4. B) Through arachnoid granulations into venous sinuses - Arachnoid granulations act as one-way valves, draining CSF into the dural venous sinuses.

5. Bleeding between the skull and dura mater is called an epidural hematoma The dura mater is tightly attached to the skull, so blood pools and compresses the brain rapidly Rising pressure can push brain tissue and quickly become life-threatening This is treated as a neurosurgical emergency requiring rapid drainage

6. The needle is inserted into the subarachnoid space, located between the arachnoid mater and pia mater CSF fills this space and surrounds the spinal cord The lumbar region (below L1-L2) is chosen because the spinal cord itself ends around L1-L2, avoiding injury to neural tissue Below this level, only nerve roots (cauda equina) float in CSF, making the tap safer

7. CSF continues to be produced by the choroid plexus but cannot drain past the blockage Fluid accumulates in the lateral and third ventricles The ventricles enlarge and pressure builds inside the skull This condition is called obstructive hydrocephalus

8. Dura mater, arachnoid mater, and pia mater.

9. By the choroid plexus, located within the brain's ventricles.

10. In the subarachnoid space, located between the arachnoid mater and the pia mater.