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Instructor: Dr. Arooba.

Assignment for viva.

Question: Write a note on cerebrospinal fluid, its circulation and absorption.

**Cerebrospinal fluid:** Cerebrospinal fluid (CSF) is a clear, colorless body fluid found in the brain and spinal cord. It is produced by specialised ependymal cells in the choroid plexuses of the ventricles of the brain, and absorbed in the arachnoid granulations. There is about 125 mL of CSF at any one time, and about 500 mL is generated every day. CSF acts as a cushion or buffer, providing basic mechanical and immunological protection to the brain inside the skull. CSF also serves a vital function in the cerebral autoregulation of cerebral blood flow.

CSF occupies the subarachnoid space (between the arachnoid mater and the pia mater) and the ventricular system around and inside the brain and spinal cord. It fills the ventricles of the brain, cisterns, and sulci, as well as the central canal of the spinal cord. There is also a connection from the subarachnoid space to the bony labyrinth of the inner ear via the perilymphatic duct where the perilymph is continuous with the cerebrospinal fluid. The ependymal cells of the choroid plexuses have multiple motile cilia on their apical surfaces that beat to move the CSF through the ventricles.

A sample of CSF can be taken via lumbar puncture. This can reveal the intracranial pressure, as well as indicate diseases including infections of the brain or its surrounding meninges. Although noted by Hippocrates, it was only in the 18th century that Emanuel Swedenborg was credited with its rediscovery, and as late as 1914 Harvey Cushing demonstrated CSF was secreted by the choroid plexus.

**CSF circulation and absorption:**

CSF is formed within the ventricles by small, delicate tufts of spe­cialized tissue called the choroid plexus. The solid arrows in the draw­ing below, Cerebrospinal fluid (CSF) Circulatory Pathway, show the major pathway of CSF flow. Beginning in the lateral ventricles, CSF flows through two passageways into the third ventricle. From the third ventricle it flows down a long, narrow passageway (the aqueduct of Sylvius) into the fourth ventricle. From the fourth ventricle it passes through three small openings (foramina) into the subarachnoid space surrounding the brain and spinal cord. CSF is absorbed through blood vessels over the surface of the brain back into the bloodstream. Some absorption also occurs through the lymphatic system. Once in the bloodstream, it is carried away and filtered by our kidneys and liver in the same way as are our other body fluids.

The ventricular system is the major pathway for the flow of CSF. CSF also flows directly from the ventricles into the brain tissue sur­rounding them. This is shown by the broken arrows. Here the CSF passes through the spaces between the cells to where it eventually enters the subarachnoid space. It is believed that the brain tissue does not absorb any CSF, but simply provides another pathway for the fluid moving to the subarachnoid space. Some small amounts of CSF are also absorbed into lymphatic channels along the membranes covering the nerves (nerve sheaths) as they leave the brain stem and spinal cord .

Our bodies produce approximately a pint (500 ml) of CSF daily, continuously replacing CSF as it is absorbed. Under normal conditions there is a delicate balance between the amount of CSF that is pro­duced and the rate at which it is absorbed. Hydrocephalus occurs when this balance is disrupted. Although there are many factors that can disrupt this balance, the most common is a blockage, or obstruc­tion, somewhere along the circulatory pathway of CSF. The obstruction may develop from a variety of causes, such as brain tumors, cysts, scarring and infection.