FACTORS INVOLVED IN CEREBROSPINAL FLUID VOLUME REGULATION

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Aim
According to the new hypothesis of cerebrospinal fluid (CSF) physiology, hydrostatic and osmotic forces between blood and interstitial/cerebrospinal fluid (ISF/CSF) across the vast surface of central nervous system (CNS) capillaries are main factors in regulation of ISF/CSF volume.

Methods
To test this hypotesis at ventricular level, experiments were performed on anesthetized cats. Three different experimental models were used (ventriculo-cisternal perfusion, model of spontaneous CSF leakage, ventriculo-aqueductal perfusion). In the ventriculo-aqueductal perfusion model (which has been developed in our laboratory), it has been noticed that there is no net formation of CSF volume inside the isolated ventricles even during the period of several hours.

Results
During the perfusion of isolated ventricular system by isoosmolar mock CSF in ventriculo-aqueductal perfusion model, the same volume that has been infused was also collected. However, an increase of the perfusate osmolarity instantly lead to an increase of the output volume, and even greater output volume was collected if the same hyperosmolar mock CSF was used to perform a ventriculo-cisternal perfusion (perfusion accross the greater/wider CSF system surface). It was noticed on the models of spontaneous CSF leakage that an increase of the blood osmolarity decreased the output CSF volume, and that a decrease of blood osmolarity increased the output CSF volume, together with a decrease in cerebral metabolites concentration, such as 5-HIAA and HVA.

Conclusion
These results clearly indicate that CSF volume inside the isolated ventricles, as well as inside the entire CSF system, is under the influence of/controlled by osmotic forces that exist inside the CSF system and CNS microvessels.