

SYMPOSIUM: CSF SIGNALLING AND CSF BIOMARKERS

PERFUSION METHODS IN DETERMINATION OF CEREBROSPINAL FLUID NET FORMATION AND UNIDIRECTIONAL FLOW

Professor Marijan Klarica, Dr. Sc.

Department of Pharmacology School of Medicine, University of Zagreb, Croatia

First scientific and experimental approaches to the study of cerebrospinal fluid (CSF) formation began almost a hundred years ago. Despite such a long interest of researchers, some aspects of CSF formation are still insufficiently understood. The generally accepted hypothesis on cerebrospinal fluid (CSF) hydrodynamics suggests that CSF is actively formed mainly by choroid plexuses, circulates unidirectionally along brain ventricles and subarachnoid space, and is passively absorbed mainly into dural venous sinuses.

CSF formation rate (V_f) has been extensively studied by the ventriculo-cisternal perfusion technique (it has been established by Heisey et al.), and obtained results have been most frequently used as the key evidence to confirm such hypothesis. However, this method is indirect and any dilution of the indicator substance in the perfusate caused by other reasons would result in questionable and often contradictory conclusions regarding CSF formation rates.

In spite of general acceptance of hypothesis, there is a considerable series of experimental results that do not support the idea of active nature of CSF formation and the idea of choroid plexuses inside brain ventricles as the main places of formation. In our laboratory a new ventriculo-aqueductal perfusion method has been introduced for determination of CSF formation inside the isolated brain ventricles. This method provides the possibility of direct insight into CSF formation.

Results clearly indicate that the CSF formation and absorption inside the brain ventricles are in balance. In addition, unidirectional bulk flow is not observed by this direct technique.

These results are contradictory to the classic hypothesis and, together with other mentioned contradictory results, strongly support a recently proposed new hypothesis on the hydrodynamics of CSF. According to this new hypothesis, the CSF is permanently produced and absorbed in the whole CSF system as a consequence of filtration and reabsorption of water volume through the capillary walls in surrounding brain tissue.