International Congress Series 1304 (2007) 150–158

www.ics-elsevier.com

Tryptophan metabolism via serotonin in human CSF of different brain sites using a new neuroendoscopic technique

P. Longatti [a], S. Comai [b,*], A. Perin [a], A. Bertazzo [b], V. Rizzo [c], E. Ragazzi [d], C.V.L. Costa [b], G. Allegri [a]

[a] *Neurosurgical Unit, "Ca' Foncello" Hospital, 31100 Treviso, University of Padova, Italy*
[b] *Department of Pharmaceutical Sciences, University of Padova, via Marzolo 5, I-35131 Padova, Italy*
[c] *Department of Biochemistry, IRRCS Policlinico San Matteo, University of Pavia, Pavia, Italy*
[d] *Department of Pharmacology and Anaesthesiology, University of Padova, Padova, Italy*

Abstract. A new neuroendoscopic technique has permitted a precise and accurate exploration of all the cerebral ventricles, making possible the study of the CSF of the lateral ventricles and, above all, the CSF adjacent to the walls of the third ventricle in humans. The concentrations of tryptophan and its metabolites via serotonin were measured in the CSF of different sites of the cerebral cavity, in particular in the third ventricle. Patients affected with non-communicating hydrocephalus undergoing neuroendoscopic third ventriculostomy were enrolled in the study. As controls, subjects not suffering from any neurological disease, who underwent lumbar subarachnoid anaesthesia for minor surgical procedures, provided lumbar CSF, and patients affected by Chiari malformation provided cisternal and right ventricular CSF. Tryptophan concentration was higher in right ventricular CSF than in lumbar CSF. Serotonin (5-HT) was detectable in the CSF of the right ventricle of hydrocephalic individuals. 5-Hydroxyindoleacetic acid (5-HIAA) was higher in the right ventricular CSF than in the cisternal and lumbar CSF both in controls and hydrocephalic subjects. However, the 5-HIAA level was higher in the right ventricular and cisternal CSF in hydrocephalic individuals in comparison to controls. 5-HT presented the highest concentration in the pineal recess, whereas the highest amounts of 5-HIAA were found in the choroids plexus, third and right ventricles and the lowest in the pineal recess, subarachnoid space and intepeduncular cistern. Melatonin is more concentrated within the ventricles, in particular the third ventricle, and

* Corresponding author. Tel.: +39 049 8275331; fax: +39 049 8275366.
E-mail address: stefano.comai@unipd.it (S. Comai).

doi:10.1016/j.ics.2007.07.009

in the CSF pineal recess. The use of this neuroendoscopic technique in hydrocephalic patients provides new insight into the metabolic pathway of tryptophan via serotonin in the CSF.

Keywords: Via serotonin; CSF; Neuroendoscopy; Non-communicating hydrocephalus

1. Introduction

A recent minimally invasive neuroendoscopic technique, applied to humans for the first time by Longatti et al. [1], has permitted a precise and accurate exploration of all the cerebral ventricles, reaching the cerebral ventricles in a quick, reliable and harmless way. This technique has been used to study the metabolism of serotonin (5-HT) in the human central nervous system (CNS), by analysing CSF tryptophan and its derivatives via serotonin in different points of the cerebral cavity, in particular in the third ventricle. Until recently, brain concentrations of these compounds were determined post-mortem or by using CSF [2–4]. Recently, Young et al. [5] used positron emission tomography (PET) for studying 5-HT synthesis in the human brain. Neuroendoscopy could represent a new approach that, by means of flexible endoscopes, allows the study of the CSF of the lateral ventricles and, above all, the CSF adjacent to the walls of the third ventricle. The most common procedure using the neuroendoscopic technique is the third ventriculostomy performed in patients affected with non-communicating hydrocephalus [6–8], where a disturbance of formation, flow or absorption of CSF occurs, leading to an increase in volume occupied by this fluid in the CNS and to non-communication between ventricular and subarachnoid space with block of CSF flow.

The aim of this study was to investigate the presence of possible abnormalities on tryptophan metabolism via serotonin in the human ventricular CSF. The following compounds were measured: tryptophan (Trp), 5-hydroxytryptophan (5-HTP), 5-hydroxytryptamine (serotonin; 5-HT), 5-hydroxyindoleacetic acid (5-HIAA), and melatonin (MLT) in human CSF withdrawal from different brain sites.

2. Materials and methods

2.1. Patients

Patients affected with non-communicating hydrocephalus undergoing neuroendoscopic third ventriculostomy were enrolled in this study; as controls, subjects not suffering from any neurological disease, who underwent lumbar subarachnoid anaestesia for minor surgical procedures, provided lumbar CSF. Patients affected by Chiari malformation provided cisternal and right ventricular CSF. All the patients were admitted at the Neurosurgical Unit of the “Ca’ Foncello” Hospital, University of Padova (Treviso), Italy, and, after adequate information about the treatment planned for them according to the indications of the local Ethics Committee, they gave their consent both to the surgical procedure and to the CSF sampling.