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The altered expression of aquaporin 1 and 4 in choroid plexus of congenital hydrocephalus

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Background

Aquaporins are a group of bidirectional transmembrane water channels that are involved in maintaining brain water homeostasis. Aquaporin 1 is primarily expressed in the ventricular choroid plexus, and it is involved in cerebrospinal fluid production. Aquaporin 4 is localized to the astrocyte end feet, ependyma, and glia limitans. The present study documents the alteration of expression of aquaporins 1 and 4 in hydrocephalus, and the ability of Vinpocetine (a vinca alkaloid that activates the pKC pathway) to regulate AQP1 and 4 in a choroid plexus cell line.

Materials and methods

The expression of AQP 1 and 4 in brains of 10-day-old congenital hydrocephalic H-Tx and unaffected siblings was studied using quantitative RT-PCR, Western blot, immunohistochemistry and ELISA. An immortalized rat choroid plexus cell line (TR-CSFB) was treated with Vinpocetine and the change in AQP levels quantified by ELISA.

Results

We found that the expression of AQP1 was moderately decreased in the whole brain and cortex of hydrocephalic rats, and it significantly decreased in the choroid plexus, as shown by Western blot and ELISA. qRT-PCR showed a significant 44% decrease of AQP1 levels in choroid plexus and no change in the whole brain. Aquaporin 4 was ele-

vated in whole brain and cortex as reported by others, whereas it was slightly decreased in the choroid plexus in Western and ELISA. In the hydrocephalic H-Tx rat brain, AQP1 expression is reduced mainly in the choroid plexus, ependymal epithelial layer, and cerebellum, but not in other regions of brain. On treatment with Vinpocetine, the expression of AQP1 and 4 was upregulated in choroid plexus cells.

Conclusion

It is significant that AQP1 and 4 was decreased in the choroid plexus. Agents that can modulate the expression of these proteins may offer nonsurgical vectors for hydrocephalus therapy. We are currently evaluating the effect of various drugs on the expression of AQP1 and 4 in choroid plexus cell cultures to that end.