IJAE
Vol. 118, n. 2 (Supplement): 9, 2013
ITALIAN JOURNAL OF ANATOMY AND EMBRYOLOGY

Expression of the K-Cl co-transporter KCC2 in cerebral cortex and thalamus during murine postnatal development

Alida Amadeo[1], Marco Ferrari[1], Patrizia Aracri[2], Maria Enrica Pasini[1], Sara Smondel[1] and Andrea Becchetti[2]

[1] Department of BioSciences, University of Milan, 20133 Milan, Italy
[2] Department of Biotechnology and Biosciences, University of Milano-Bicocca, 20126 Milan, Italy

In the adult central nervous system GABA mediates fast inhibitory transmission, whereas during development it is an excitatory transmitter and a trophic factor involved in controlling morphogenesis (Ben-Ari, 2002). This funcional shift occurs as a result of a progressively increasing expression of the KCC2 cotransporter, the major chloride extruder in mature neurons. In several pathological conditions associated with hyperexcitability, such as epilepsy, suppression of KCC2 may contribute to alter the balance of excitation and inhibition (Chamma et al., 2012), especially during neural circuit formation. On these basis we studied the expression of KCC2 in two representative areas of neocortex, somatosensory and prefrontal (PFC), and in the dorsal thalamus, at different postnatal stages by western blot and immunocytochemical analysis. Our results show conspicuous expression of KCC2 at postnatal day 0 (P0) in the neuropil of thalamic nuclei, except the reticular nucleus. Lower expression is observed in cortical areas, with PFC displaying the lowest signal. In the first postnatal week, KCC2 is mainly localized in the cell bodies of cortical GABAergic neurons and pyramidal cells. After P7, it is gradually distributed in the membranes of the whole somatodendritic compartment, becoming prevalent in the neuropil by P14. In the adult cortices an intense labelling for KCC2 is observed in the supragranular layers if compared with the moderate expression of layer V; in the thalamus the anterior and sensory nuclear groups show the highest immunoreactivity. Overall, our results suggest a complex spatiotemporal pattern of KCC2 expression in the murine prosencephalon that needs to be related not only with inhibitory transmission but also with the different arrangements of neuronal circuits in cortical and thalamic subregions.

References

[1] Ben-Ari Y (2002) Excitatory actions of GABA during development: the nature of the nurture. Nat Rev Neurosci 3(9): 728-739.
[2] Chamma et al. (2012) Role of the neuronal K-Cl co-transporter KCC2 in inhibitory and excitatory neurotransmission. Front Cell Neurosci 6: 5.

Key words
Development, GABA, cerebral cortex, thalamus, immunocytochemistry.