Expression of voltage-gated potassium ion channel gene KCNQ3 in mouse thymus

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Background: The ion channels are transmembrane protein localized in cell membrane and a passage of the ion controlled by various stimulations. Potassium ion channels are expressed in the heart, lung, central nervous system and other organs. They takes important parts in proliferation and classification of the cells, which is expressed in immune cells, e.g. thymus, recently.

Objective: In general, voltage-gated potassium channels KCNQ2 and KCNQ3, which are known to be one of the responsible genes for benign familial neonatal convulsion (BFNC), are thought to be expressed specifically in central nervous system. However, we found an EST clone encoding the mRNA for KCNQ3 in the thymus cDNA library. This finding, together with the growing evidence for the involvement of the potassium channels in immune system, prompted us to examine the expression of KCNQ3 in the thymus.

Methods: Reverse transcription-polymerase chain reaction (RT-PCR), real-time PCR analysis, in situ hybridization and immunofluorescense staining were performed on the thymus preparations in mice.

Results: The RT-PCR, by using specific primers of KCNQ3, showed a band of 240 bp as an expected size, which was confirmed to be the KCNQ3 by the direct sequencing. Real-time PCR analysis demonstrated that the expression level of the KCNQ2 and KCNQ3 in the thymus was approximately 7% of that in the brain. Interestingly, in situ hybridization and immunofluorescense staining revealed that the KCNQ3 was expressed in a certain type of the cells in the thymus.

Discussion: Potassium ion channel molecules other than KCNQ2 and KCNQ3 have been known to be expressed in the immune cells. For example, Kv1.3 takes important parts in proliferation and classification of the cells. Moreover, there is a report that compared with WT (wild type) in knockout mice, KCNE1 overincrease mature T cells, when it combined with KCNQ1, and has a function. So there is a possibility that KCNQ2 and KCNQ3 molecules may have functions in immune system.

Some studies have reported the relation between epilepsy and the immunological disorder. Although it has been reported that refractory epilepsy such as West syndrome has decreased CD3 and CD4 or elevated CD8, relationship between BFNC and immunological disorder has not been previously reported.

Conclusions: This study provides the first evidence for the expression of KCNQ2 and KCNQ3 in the thymus, and suggests the possibility of an unkown function of the KCNQ2 and KCNQ3 in the immune system.

References