

## 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 immunofluorescence 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 immunofluorescence 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.<sup>1</sup> 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<sup>2</sup>, 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 unknown function of the *KCNQ2* and *KCNQ3* in the immune system.

### References

1. Koni PA, Khanna R, Chang MC, *et al.* Compensatory anion currents in Kv1.3 channel-deficient thymocytes. *J Biol Chem* 2003; 278: 39443-51.
2. Montelli TC, Soares AM, Peracoli MT. Immunologic aspects of West syndrome and evidence of plasma inhibitory effects on T cell function. *Arq Neuropsiquiatr* 2003; 61: 731-7.