Applied physiology of vasopressin-eGFP transgenic rats to study regulation of sodium and body fluid balance

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Summary

Vasopressin is well known to be an antidiuretic hormone in the kidney. The magnocellular neurosecretory cells (MNCs) in the supraoptic (SON) and the paraventricular nuclei (PVN) of the hypothalamus synthesize vasopressin in abundance The MNCs terminate their axons to the posterior pituitary and secrete vasopressin in the systemic circulation. The neuronal activity of vasopressin-secreting neurons is controlled by synaptic inputs and humoral factors such as plasma osmolality, concentration of sodium and cardiovascular-related peptides.

We generated transgenic rats expressing vasopressin-enhanced green fluorescent protein (eGFP) fusion gene. The expression of the eGFP gene were clearly observed in the SON and the PVN in transgenic rats. In metabolic cage both transgenic rats and controls did not show any different consumption of drinking and feeding, urinary volume, urine osmolality and sodium concentration in urine under normal condition and after chronic salt loading (2% saline to drink) for 5 days. After chronic salt loading the expression of the eGFP gene and the fluorescence were marked increased in the SON and the magnocellular division of the PVN. The eGFP fibers were also increased in the internal layer of the median eminence after salt loading. In *in vitro* slice preparation the whole cell patch clamp technique was used to record the electrical activity from the identified eGFP-expressing neurons in the SON. In addition, isolated SON neurons and axon terminals in the posterior pituitary gland showed robust eGFP fluorescence.

The vasopressin-eGFP transgenic rat is a unique new tool to study the physiological role of vasopressin-secreting neurons in salt balance and water homeostasis and the dynamics of the regulation of vasopressin secretion in living neurons and their axon terminals.