Vagal Influences on ADH Release in the Conscious Dog

There are data indicating that the spontaneous activity and the osmotic reactivity of the hypothalamo-hypophyseal antidiuretic system are reflexly influenced by the isoosmotic changes of the blood volume[1-3]. Centripetal fibers of the vagus nerves (especially in the left vagosympathetic trunk) are suggested[3] as a pathway conveying impulses from the cardiac volume receptors to the hypothalamo-hypophyseal antidiuretic system. However, there is no convincing evidence that these impulses tonicaly inhibit activity of the antidiuretic system. If this mechanism exists, the rise of the activity of the hypothalamo-hypophyseal antidiuretic system after cervical vagosympathectomy is to be expected.

Material and methods. The experiments were performed on 15 male mongrel dogs. The animals were kept fasting for 18 h preceding the experiments but they had free acces to water. All experiments were carried out at the same time of the day. The plasma ADH level in resting conditions and an increase of the plasma ADH level to standard osmotic stimuli were taken as a measure of the spontaneous activity and of the osmotic reactivity of the hypothalamo-hypophyseal antidiuretic system respectively. In each dog these measurements were repeated several times before and after left side vagosympathectomy. Osmotic load producing cellular dehydration equal to 5% of initial amount of intracellular water was used as a standard osmotic stimulus. Its value could be calculated in each dog from osmometric equations[4] with the previously measured total body water extracellular water and extracellular sodium concentration.

The osmotic load was introduced by means of i.v. infusion of 5% NaCl solution at a constant rate of 7.5 ml/min. At the begining of the experiment, a blood sample was drawn to determine plasma ADH and Na concentration. The dog's bladder was catheterized and emptied. When the infusion was stopped, a blood sample was taken again for plasma ADH determination. Urine excreted during infusion was collected, its volume and Na concentration were determined. The plasma ADH level was determined by a modified method of CZACZKES et al.[5]. Concentration of Na in samples was determined with Zeiss III flame photometer. Extracellular space was measured by using sodium thiocyanate. Total body water was calculated as a percent of body weight. Vagosympathectomy was performed under hexobarbital anaesthesia. Left vagosympathetic trunk was exposed and a piece of the nerve 1 cm long was excized at the level of the thyroid cartilage. The experiments were made 10 days following the surgery.

Results and discussion. In each dog the plasma ADH level increased after left side vagosympathectomy (Figure 1). The level of ADH in plasma before, and 10 days after, vagosympathectomy were 2.3 $\pm$ 0.9 μU/ml and 4.5 $\pm$ 1.2 μU/ml ($M \pm$ SE), respectively, the difference between these 2 values 2.2 $\pm$ 0.5 μU/ml was statistically significant ($p < 0.01$). After a month the plasma ADH level declined to 3.0 $\pm$ 0.9 μU/ml but it was still higher than before vagosympathectomy. The difference 0.9 $\pm$ 0.3 μU/ml was statistically significant ($p < 0.01$). Osmotic reactivity of the antidiuretic system also increased after vagosympathectomy (Figure 2). The rise of the ADH level in response to a standard osmotic stimulus was greater in the vagosympathectomized (9.8 $\pm$ 1.1 μU/ml) than in the intact dogs (6.1 $\pm$ 0.8 μU/ml). The difference 3.8 $\pm$ 0.8 μU/ml was statistically significant ($p < 0.01$). No changes of plasma ADH level were found in a group of shame-operated dogs.

The results indicate that the section of the left vagosympathetic trunk enhances the activity of the hypothalamo-hypophyseal antidiuretic system. This cannot be caused by the surgical trauma because the experiments were performed not earlier than 10 days following operation. The most probable reason is the release of the antidiuretic system from the inhibiting action of impulses tonically discharged in volume receptors with normal filling of vascular bed. Decrease of plasma ADH titer 1 month following the surgery may be due to increased activity of the antidiuretic system inhibiting receptors which do not exert their action in intact dogs. The augmentation of the activity of the antiduretic system may be at least partially responsible for the increase of the total body water observed after vagosympathectomy[6].

Résumé. On a comparé le taux de l'ADH plasmatique et la réactivité osmotique du système antidiurétique hypothalamo-hypophysaire avant et après l'interruption du tronc vagosympathique gauche au niveau du cartilage cricoïde chez les chiens nonnarcotisés. La vagosympathectomie a produit une augmentation de la concentration de l'hormone antidiurétique dans le plasma du sang aussi bien qu'une réactivité osmotique du système antidiurétique.

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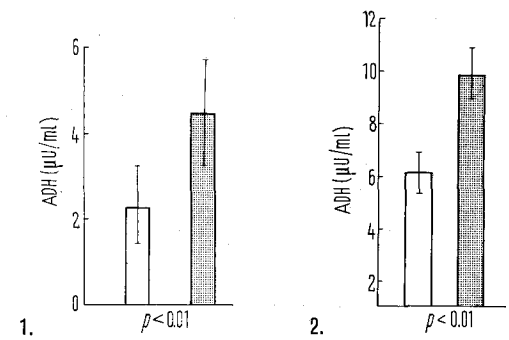

Fig. 1. The plasma ADH level before (white column) and after (dashed column) left side vagosympathectomy.

Fig. 2. The rise of the plasma ADH level to a standard osmotic stimulus before (white column) and after (dashed column) left side vagosympathectomy.

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