EFFECT OF THE VAGUS NERVES ON RENAL HEMODYNAMICS AND TUBULAR ACTIVITY

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Stimulation of the right vagus nerve in depancreatized dogs inhibits the plasma flow, glucose reabsorption, and secretion in both kidneys but does not change electrolyte transport. In animals receiving acetylcholine and lipocaic, stimulation of the right vagus nerve leads to an increase in the renal hemodynamics, the secretion, and the glucose reabsorption in both kidneys. The kidneys receive a crossed innervation by cholinergic and adrenergic fibers of the right vagus nerve.

KEY WORDS: vagus nerve; acetylcholine; renal tubular activity.

Some workers [3] deny any influence of the vagus nerves on renal function, although the writer previously demonstrated their influence on the activity of the glomerular and tubular apparatus [2]. The investigation described below was carried out to make a more detailed study of the role of the vagus nerves and of acetylcholine in the regulation of renal function.

EXPERIMENTAL METHOD

To examine the role of acetylcholine, its synthesis was disturbed by partial depancreatization [1]. Chronic experiments were carried out on 10 dogs with the ureters exteriorized separately: five dogs received a daily intravenous injection of 1.5–2 ml acetylcholine in a concentration of 1:100,000 together with 50 units lipocaic [1] by way of compensation. Filtration (as inulin), the plasma flow and tubular secretion (as cardiotrast), glucose reabsorption, sodium reabsorption, and sodium and potassium excretion were determined [2]. The vagus nerves were stimulated below the diaphragm on the 4th–9th day after depancreatization [2]. Altogether 41 experiments were performed.

EXPERIMENTAL RESULTS

In the kidney of the depancreatized dogs on the side of stimulation of the right vagus nerve for 5–10 min a decrease was observed in the plasma flow from 156 ± 8.6 to 120 ± 10.5 ml/min/m^2 ($P < 0.01$), in the secretion from 8.9 ± 0.4 to 4.2 ± 1.2 mg/min/m^2 ($P < 0.05$), and in the glucose reabsorption from 129 ± 31 to 84 ± 21 mg/min/m^2 ($P < 0.05$). Similar changes were also observed in the opposite kidney, indicating the crossed innervation of the nephrons by fibers of adrenergic nature. The inhibition of the renal hemodynamics did not affect electrolyte transport and was the result of vasoconstriction of the renal vessels. Glucose reabsorption was reduced because of the fall of filtration and the reduction in the quantity of glucose filtering through in the glomeruli. In the kidney on the side of stimulation of the right vagus nerve in the depancreatized animals receiving acetylcholine and lipocaic, on the other hand, there was an increase in filtration from 37 ± 0.7 to 50 ± 0.9 ml/min/m^2 ($P < 0.001$), in the plasma flow from 172 ± 2.9 to 213 ± 5.4 ml/min/m^2 ($P < 0.001$), in secretion from 10 ± 0.4 to 15 ± 0.2 mg/min/m^2 ($P < 0.001$), and in glucose reabsorption from 96 ± 1.0 to 128 ± 3.7 mg/min/m^2 ($P < 0.001$). The increase in these indices of

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renal function on the opposite side is explained by the participation of cholinergic fibers in the response. Stimulation of the left vagus nerve had no effect on tubular activity. Consequently, cholinergic and adrenergic fibers running in the right vagus nerve provide a crossed innervation for the kidneys.

LITERATURE CITED

1. I. N. Volkova, in: Neuro-Humoral Regulation Under Normal and Pathological Conditions [in Russian], Vol. 24, Kazan' (1967), p. 5.
2. M. I. Mavrin, Byull. Éksperim. Biol. i Med., No. 4, 15 (1973).
3. J. Concha and B. Norris, Brit. J. Pharmacol., 34, 227 (1968).