

INFLUENCE OF THE VENTROLATERAL HYPOTHALAMIC
NUCLEI ON THE BLOOD CHOLESTEROL LEVEL
IN RABBITS

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Daily stimulation of the ventrolateral hypothalamic nuclei leads to an increase in the blood cholesterol concentration in rabbits, which persists for a long time. After destruction of the nuclei there was a temporary fall in the blood cholesterol level followed by its return to normal.

After a lesion of the ventromedial (VM) hypothalamic nuclei and during stimulation of the ventrolateral (VL) nuclei, hyperphagia and obesity develop [11]. Conversely, after stimulation of VM and destruction of VL, hypophagia and emaciation arise.

Subsequent investigations have shown that the VM hypothalamic nuclei are concerned with cholesterol metabolism and, in particular, an increase in the cholesterol level has been observed after destruction of the VM nuclei [7, 12]. On the other hand, the same effect was observed when these nuclei were stimulated [6, 10]. The writers [4] have found an increase in the cholesterol concentration after destruction of the VM nuclei and a decrease during stimulation of these nuclei.

The writers' previous investigation of the bioelectrical activity of these structures [2, 5] suggests that the VM nuclei are afferent while the VL are efferent centers. It was therefore decided to study the effect of electrocoagulation and also of electrical stimulation of the VL nuclei on the blood cholesterol concentration.

EXPERIMENTAL METHOD

Experiments were carried out on 16 male rabbits of similar weight and age. Electrodes were implanted by means of a mark MP stereotaxic apparatus. The coordinates of the corresponding structures were calculated with reference to the stereotaxic maps in the atlas of Bures et al. (1962). Correct insertion of the electrodes was verified roentgenographically, and also histologically after the end of the experiments. The blood cholesterol was determined by Elk's method. Electrical coagulation of the nuclei was carried out by a direct current of 4 mA for 40 sec. The same structures were stimulated daily by means of the IE-1 electrical stimulator with a current of 0.2 mA for 30 sec.

EXPERIMENTAL RESULTS

After destruction of the VL hypothalamic nuclei, the weight of the rabbits decreased during the first 20 days of the experiment. After the 20th day it began to rise again. During stimulation of these nuclei there was some increase in the weight of the animals, followed by its stabilization.

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The blood cholesterol concentration of the control animals at the beginning of the experiment had a mean value of 59 ± 5.0 mg% and it did not change significantly during 70 days of the experiment. After destruction of the VL nuclei the blood cholesterol concentration on the 10th day was reduced to 37 ± 2.6 mg% (from 64 ± 2.5 mg% before destruction; $P < 0.02$) and it remained low until the 30th day (37 ± 2.6 mg%; $P < 0.05$). Subsequently the blood cholesterol concentration rapidly reached its initial level (on the 40th day of the experiment) and at the end of the experiment it was 60 ± 4.5 mg% ($P > 0.1$). Stimulation of the VL nuclei caused an increase in the blood cholesterol concentration on the 10th day of the experiment to 103 ± 5.6 mg% (initial level 64 ± 3.0 mg%; $P < 0.01$). This high cholesterol level in the blood was maintained until the 50th day of the experiment, after which it fell slightly, while still remaining above normal (83 ± 5.6 mg%).

The clearest increase in the blood cholesterol level during stimulation of the VL nuclei was observed between the 10th and 50th days of the experiment. Destruction of these structures led to a temporary decrease in its concentration in the period between the 10th and 30th days of the experiment.

These changes were evidently due to the influence of the VL nuclei on the functions of certain endocrine glands. For instance, stimulation of these structures probably inhibits thyroid function, which is accompanied by an increase in the blood cholesterol level [1, 3, 8]. Destruction of the same nuclei possibly causes a temporary increase in the function of the thyroid gland, and this may lead to a decrease in the blood cholesterol concentration [8, 9]. The possibility that these nuclei may also influence the functions of other glands likewise cannot be ruled out [4].

Other brain structures can take over the function of the VL hypothalamic nuclei, but this takes time. This may be the explanation of the temporary fall in the blood cholesterol level after destruction of the VL nuclei.

During stimulation of these structures, on the other hand, the high cholesterol level is maintained for a longer time. This result is explained by the fact that these nuclei, in the writers' opinion, are the efferent link in a single reflex chain from the food center and they have a stimulant effect on thyroid function.

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