

CHANGES IN BLOOD CHOLESTEROL, PROTEIN FRACTIONS, AND LIPOPROTEINS IN FUNCTIONAL DISTURBANCES OF THE CENTRAL NERVOUS SYSTEM

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An important etiological factor in the development of metabolic changes in atherosclerosis is a change in the state of the higher neuroregulatory mechanisms [1, 6]. It has been found that emotional excitation, oxygen lack, toxic and destructive processes in the brain, and partial or total decerebration are accompanied by hypercholesteremia [2, 8, 11]. During changes in the functional state of the central nervous system following administration of neurotropic drugs [7, 12], experimental neurosis, or overstrain of conditioned-reflex activity [3, 9, 10], characteristic changes were observed in the blood proteins and lipids.

There are most references in the literature to the pathology of cholesterol metabolism during disturbances of the functions of the central nervous system, and inadequate attention has been paid to the study of changes in the protein fractions and lipoproteins of the blood.

EXPERIMENTAL METHOD

Experiments were conducted on 8 rabbits in which a system of positive and inhibitory conditioned reflexes had been established by Kotlyarevskii's motor-food method for small animals [5], modified for rabbits [4], followed by the creation of an experimental neurosis. During formation of the conditioned reflexes in the animals and while in a state of neurosis, periodic determinations were made of the total blood cholesterol level by the Engel'gardt-Smirnova method, the total protein concentration by means of the IRF-22 refractometer, and the blood protein fractions and lipoproteins by the method of paper electrophoresis with subsequent staining with bromphenol blue and Sudan black.

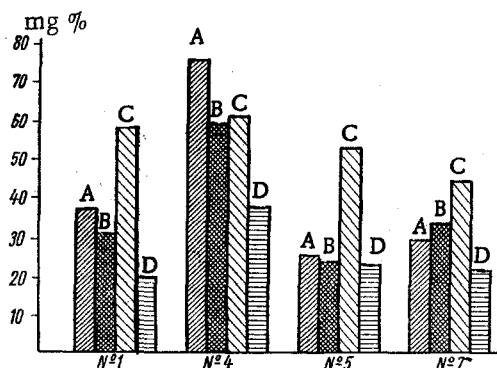


Fig. 1. Serum cholesterol concentration in rabbits before neurosis (A), on the fifth day of neurosis (B), on the ninth-thirteenth day of neurosis (C) and at the end of the experiment (D). The serial number of the rabbit is given below.

EXPERIMENTAL RESULTS

It will be clear from Fig. 1 that the mean cholesterol level before the neurosis varied between 21.6 and 71.6 mg %. During the neurosis the total cholesterol fell in 6 rabbits. In most cases (62.5%) these changes were biphasic in character: a fall in the cholesterol level was preceded by a transient rise, on the average by 30-60%, on the fifth-thirteenth day after disturbance of the functional state of the central nervous system, while in 37.5% of cases the cholesterol concentration fell from the first day of the neurosis without any preliminary rise.

In 7 rabbits a marked decrease in the albumin content from its normal level (on the average by 10-20%) was observed during neurosis. In most rabbits hypoalbuminemia was observed on the first-fifth day of the neurosis.

In rabbits Nos. 1 and 5 a fall in the albumin level was recorded on the ninth-sixteenth day of the neurosis (Fig. 2). The

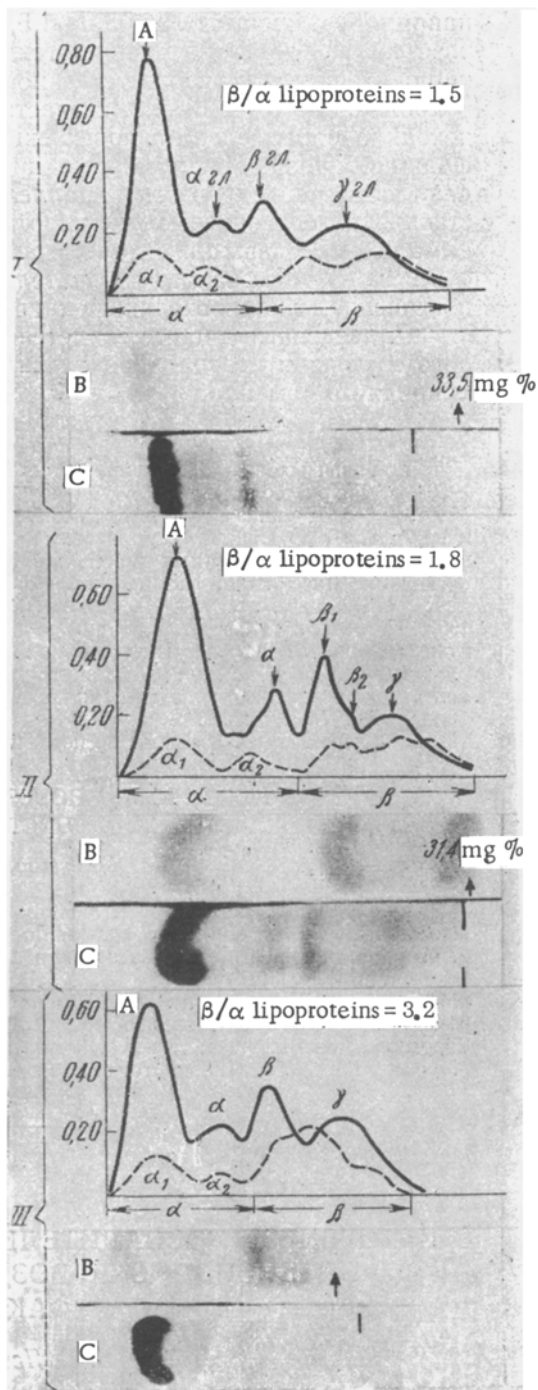


Fig. 2. Changes in relative proportions of protein and lipoprotein fractions of the blood of rabbit No. 1 during neurosis. I) Normal; II) during neurosis, on fifth day; III) on seventh day; A) electrophoresis curve of protein fractions (continuous line) and lipoprotein fractions (broken line); B) lipidogram (stained with Sudan black); C) proteinogram (stained with bromophenol blue).

fall in the albumins in all the rabbits was accompanied by an increase in the concentrations of the β - and γ -globulin fractions; in rabbit No. 5, for instance, the level of the β -globulins rose from 14.4 to 26.5%, and in rabbit No. 7 from 15.6 to 28.6% i.e., on the average an increase of 80%. In isolated cases a distinct separation of the β -fraction into β_1 - and β_2 -fractions could be observed, which was never present in a period of normal conditioned-reflex activity. The total protein showed no significant change during the neurosis.

The ratio between β - and α -lipoproteins during the period of normal conditioned-reflex activity varied between 1.0 and 2.3; in rabbit No. 1, for instance, it was 1.0-1.5 and in rabbit No. 5, 1.2-1.9. During neurosis the ratio between β - and α -lipoproteins rose and varied between wider limits, viz., between 1.8 and 3.2 in rabbit No. 1 and between 1.0 and 4.3 in rabbit No. 5. The increase in the β -protein complexes took place parallel with an increase in the concentrations of the β - and γ -globulin fractions of the blood. Our findings and those obtained by other authors [9] give no grounds for drawing a parallel between the total cholesterol concentration and the ratio between the lipoprotein fractions. For example, when the cholesterol concentration was minimal in rabbit No. 1 during neurosis (19.1 mg %) a considerable accumulation of β -lipoproteins and an increase in the lipoprotein index to 3.2 were observed (see Fig. 2).

SUMMARY

In experiments on 8 rabbits a study was made of the effect produced by nervous disorders on the protein-lipid composition of the blood. The method of electrophoresis of proteins and lipoproteins was used. In neurosis there is a drop of the total blood cholesterol, in the majority of the cases following a brief rise of its concentration in the blood; the percentage content of albumins fall with a corresponding rise of the β - and, in individual cases, of the α - and γ -globulin fractions. The β -/ α -lipoproteins ratio increases. Observations carried out testify to an important role played by the CNS in the control of cholesterol, lipid, and protein metabolism.

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All abbreviations of periodicals in the above bibliography are letter-by-letter transliterations of the abbreviations as given in the original Russian journal. *Some or all of this periodical literature may well be available in English translation.* A complete list of the cover-to-cover English translations appears at the back of this issue.