

MATERIALS ON THE STUDY OF THE NERVOUS CONTROL OF THE COMPLEMENTARY BLOOD FUNCTION

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In the literature there are several accounts [4, 6, 7, 8] mainly concerned with the investigation of the role of the vegetative nervous system in regulating the level of the blood complement.

These investigations have demonstrated that the complementary activity of blood serum is significantly increased by the action of the sympathetic nervous system, by adrenalin and by the sympathomimetic amines (ephedrine, phenamine) and inhibited by pilocarpine.

Studies of the central nervous control of the level of the blood complement are of considerable interest. It has recently been demonstrated [1, 2] by the method of conditioned reflexes that the brain cortex participates in the control of the complementary blood function.

Experiments designed to study the effect of the functional condition of the higher sections of the central nervous system particularly its inhibiting state on the level of the blood complement, play an important part in the solution of these problems. But the few articles that exist on this subject are extremely contradictory. Thus in the experiment [3] with cats, rabbits and dogs, the complement content decreased considerably under the effect of phenobarbital narcosis. Other investigators [5] however, found that the complement level decreased slightly as a result of different forms of narcosis.

The object of the present study was to determine the effect of urethane narcosis on the level of the blood complement.

EXPERIMENTAL METHOD

The tests were carried out on 30 guinea pigs each weighing 400-500 g. The animals were given intraperitoneal injections of urethane 100 mg to every 100 g of weight. Narcosis set in 3-7 min after the injection of the preparation and lasted 5-7 hr. The complement titre in every guinea pig was determined before the injection of the narcotic. For the investigation blood was taken from the heart 1.5-2 ml at a time. The blood was studied 3.6 and 24 hr after the injection of urethane and in some of the animals after 1½ and 4½ hr. The blood of 10 control guinea pigs was studied at the same periods. In all 6 series of experiments were conducted with 5 guinea pigs in each.

The complement level was determined by the usual method of titrating it in a 1 ml suspension of sheep's red cells.

In all the tests the complement titre of the serum was determined on the day after the taking of blood.

EXPERIMENTAL RESULTS

The study of the complimentary activity of blood taken from animals in a condition of deep narcosis clearly showed that the complement level of the blood depends on the inhibiting state of the central nervous system. An analysis of the results showed that in the overwhelming majority of the animals (83.4 %) the complementary activity of blood serum decreased in varying degrees and that only in 16.6% of the animals the content remained the same; it rose briefly and then dropped to the initial level. The decrease of the complement titre in different animals ranged from 42.9 to 125% of the initial level. The extent of the drop in the complement level depends apparently on the initial condition of the complementary activity of blood serum (Fig. 1); the higher the initial titre of the complement, the more marked the drop although sometimes deviations from this tendency occur.

The study of the dynamics of the changes in the complement content revealed that the complement titre did not decrease uniformly in all the animals. At this stage it was possible to distinguish 3 types of reaction which we designated as follows: type I – a smooth decrease of the complement titre reaching a maximum by the sixth hour of narcosis (Fig. 2); type II – a drop in the complement level in the early stages reaching a maximum by the third hour of narcosis (Fig. 3); type III – a sharp drop in the complement titre in the later stages reaching a maximum by the sixth hour of narcosis (Fig. 4).

A comparison of the course of decrease of the blood complement titre with its initial level shows that the type of reaction does not depend on the initial titre of the complement although the third type of reaction predominated in animals with a low initial complement titre (0.16). The third type of reaction was much more rarely encountered than the other two.

Our experimental results also show that under the action of the inhibiting state of the central nervous system there is a certain limit to the fall of the complement titre; in our tests it did not fall below 0.22-0.24.

The study of the course of the decrease of the complement in relation to time revealed not only 3 types of reaction but established the possible sources of errors in solving this problem. Thus on investigating the complement titre $1\frac{1}{2}$ hr after the onset of narcosis we failed to detect any substantial shifts whereas after $4\frac{1}{2}$ hr they were less pronounced in some animals (first type of reaction) than after 6 hr (i.e., in the terminal stages of narcosis).

The tests also showed that after 24 hr the level of the complement became more or less normal. On determining the complement titre in blood serum of 10 control animals 6 of them showed a fall in the complement titre (0.02). This was probably due to the fourfold taking of blood from the heart.

The experimental results thus demonstrate that the complementary function of blood serum is regulated by the central nervous system.

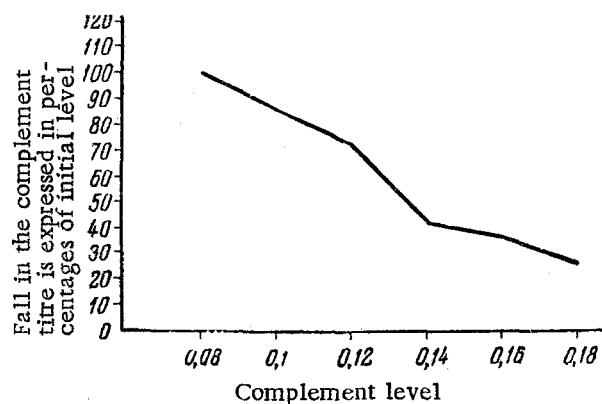


Fig. 1. Dependence of the degree of decrease of the complement titre on the initial level.

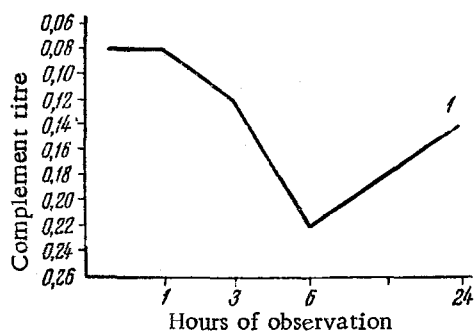


Fig. 2. Course of decrease of the complement titre in relation to time. First type of reaction – smooth decrease of the complement titre.

Despite this it is still not possible to describe definitely the mechanism of the observed phenomenon which apparently can be dual: redistributive or by lowering the production. The short term decrease of the complement content of the blood after the nervous system has ceased to exercise control over the possible organs of production of the

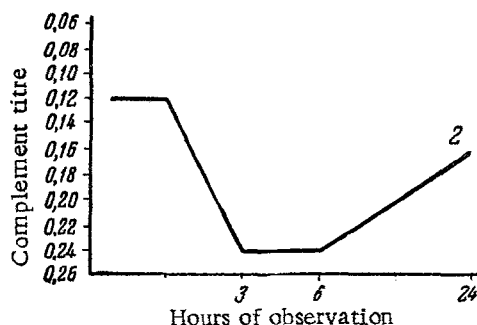


Fig. 3. Course of reduction of the complement titre in relation to time. Type II reaction – a sharp fall in the complement level in the early stages.

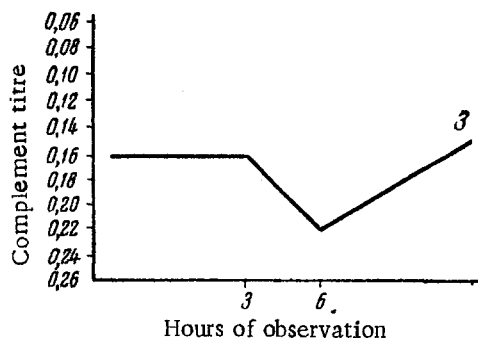


Fig. 4. Course of reduction of the complement titre in relation to time. Type III reaction – a sharp fall in the complement level in the terminal stages.

complement namely liver and the reticulo-endothelial system (9, 10, 11), and the restoration to the initial level after 24 hr indicates the redistributive type of mechanism. The return to normal after 24 hr of the lowered level of the complement after the "blockade" of the cells of the reticulo-endothelial system has also been observed by other investigators [11].

SUMMARY

Investigations carried out have demonstrated the relationship between the complementary function of the blood and the functional state of the central nervous system. Particularly it was established that prolonged anesthesia in guinea pigs led to a marked but reversible drop of the complement titre. The study of the complement reduction dynamics (with time) has revealed three types of reactions in animals.

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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.
