TREATMENT OF EXPERIMENTAL NEUROSES IN THE DOG BY MEDICAMENTOUS SLEEP

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Sleep therapy is widely applicable to the treatment of neuroses and somatic illnesses which originate from functional disturbance of the cortical activity of the cerebral hemispheres (ulcers, hypertension, etc.). In the treatment of these diseases clinicians do not always obtain positive results. For this reason there is an urgent need to work out experimental sleep therapy of neuroses in suitable animals.

In this connection the experiments of M. K. Petrova are of particular interest [1, 2], where veronal sleep therapy was carried out on dogs weakened by castration, prolonged experiments, various diseases, and dogs with senile changes in the function of the central nervous system. In all cases M. K. Petrova observed a favorable influence of sleep therapy on dogs which expressed itself by an improvement in their general condition (disappearance of dystrophic changes of the skin, etc.). A protracted restoration of conditioned reflex activity to normal was achieved in only one dog. In the other animals there was observed only an insignificant and transient improvement of conditioned reflex activity.

Our experimental work was devoted to the investigation of the questions: what disturbances of higher nervous activity yield the most improvement or normalization under the action of sleep therapy, what regime of sleep therapy shows the most favorable influence on the restoration of cortical processes, what soporific, in what combinations and doses proves to be best for the treatment of experimental neuroses.

METHODS

We carried out experiments on 5 dogs; Alpha, Fiston, Don, Orl, and Uranus. In all dogs there were produced conditioned food reflexes by the (classical) Pavlov method. A positive conditioned reflex was produced in all dogs to the sound of a metronome with a frequency of 120 beats per minute and to the light of an electric bulb of 100 candle power, the differentiated stimulus was the sound of a metronome with a frequency of 60 beats per minute. We employed the conditioning stimuli for each dog always in one and the same order, at intervals of 5 minutes. During the experiment we recorded the secretion of the salivary gland, feeding reaction, and frequency of respiration. The type of higher nervous activity was determined by the customary small standard of assay, with some exceptions (in the dogs Don, Orl and Uranus the establishment of a system of conditioned reflexes and a series of assays of the type of higher nervous activity was carried out by our scientific coworker I. A. Zachinyaeva).

Neuroses were produced by influencing the weakest side of the higher nervous function of the experimental animals. In the experiments we made use of an increase in the time of action of the conditioning stimulus, as in the course of an experimental day, or in the course of several days, weeks, or months. In dogs of a strong type, neurosis appeared as a simultaneous stress of the basic nervous processes and their mobility. For this we

used in the course of one experiment an extra loud rattle, sometimes between the conditioning stimuli, or sometimes during their action simultaneously with a sharp increase in the time of the isolated action of the positive conditioning stimulus to 50 seconds, but the differentiated stimulus to 2 minutes.

After the production of disturbances of higher nervous function in the animals, we carried out, in the course of several days, observations on the dynamics of the development of these disturbances, then broke off the experiments for 10-14 days, and if the rest did not produce improvement in the animals' condition, carried out therapy by inducing sleep.

We produced the medicamentous sleep, in a special room, for 3 to 6 days in succession. In the course of 3 days the dogs slept from 30 to 52 hours, in the course of 6 days, from 52 to 100 hours. For a soporific we employed barbamyl* and a mixture of barbamyl and chloral hydrate (1 : 3). We gave the barbamyl to the dogs with food, the mixture we introduced into the rectum.

We adjusted the doses of the soporifics, depending on the typological pecularities of the experimental animals, so that the sleep should be close to physiological sleep. In such sleep the dogs retained pain sensitivity, the corneal reflex, and the orientation reaction to a loud noise.

If after the first application of sleep therapy normalization of the higher nervous function of the animals did not ensue, then after 2-9 months we repeated the medicamentous sleep.

RESULTS

In the process of the experiments prolonged disturbances of higher nervous function were produced in dogs, which could be characterized in the terminology of the Pavlov school as neurosis with predominance of inhibition, since it is accompanied by a weakening in the first place of the process of excitation and the development in the cortex of the cerebral hemispheres of the dogs of a limiting protective inhibition.

With the dogs Fiston and Don, belonging accordingly to the weak and intermediate type of higher nervous activity, the neuroses were characterized by disturbances of general gray matter processes, but the unconditioned feeding reflex was not disturbed.

Externally these neuroses manifest themselves by a 12-80% lowering of the amount of conditioned reflexes, the constant occurrence of hypnotic intervals, mainly equalizing and paradoxical, manifestations of explosiveness and rapid exhaustion of the process of stimulation, and an increase of 25-100% in the frequency of respiration during the experiment. Dogs with these neuroses ate all their food, which was given after the action of the conditioning reflexes, and their reaction under experimental conditions was always positive. Prolonged interruption of the experiments (from 7 days to a month) did not favor improvement in the higher nervous function of the dogs with these neuroses.

In these cases, after a three day sleep under the influence of barbamyl, the magnitude of the conditioned reflexes increased 20-75%, the periodic manifestations and the manifestations of sudden exhaustion of the conditioned reflex stimulus disappeared. Normal higher nervous function was observed in these dogs in the course of 4-5 months after the application of sleep therapy.

Prolonged disturbance of higher nervous function, obtained in dogs Alpha, Orl, and Uranus (assigned accordingly to the strong type with some predominance of the excitatory process, to the strong stable, and to the weak type of higher nervous activity), was characterized by disturbances of the course of gray matter processes and a sharp disturbance of the unconditioned feeding reflex. Refusal of food by the animals during the experiment, either in the presence of the experimenter or in his absence, was observed for several months to 2 $^1/_2$ years. Apart from this, there was observed chaotic conditioned reflex activity, a considerable decrease or complete disappearance of conditioned secretion, an increase to 8-20 times in respiration during the experiment and the continued presence in the animals of a negative reaction to the conditions of the experiment (they had to be carried to the machine in the arms). Complete starvation for 1-9 days worsened the dog's higher nervous activity. Interruptions of the experiments for 10-50 days did not promote improvement of the condition of the animals. Three day and six day sleep under the influence of barbamyl produced a slight and temporary improvement in the conditioned reflexes for 2-3 days which was expressed as some increases in the magnitude of the conditioned secretion, a decrease in the respiration rate during the experiment, and more active behavior of the animals under the experimental conditions.

* Russian trade name.

We induced sleep by a mixture of soporifics for 3 days. We introduced the soporific barbamyl and chloral hydrate into the rectum at intervals of 15-20 minutes. To dogs of the weak type of higher nervous activity we gave 2 g of this mixture, to dogs of the strong type, 2.6 g.

In neuroses which manifested themselves as disturbances of the conditioned feeding reflexes without expression of disturbances of the unconditioned feeding reflex, sleep under the influence of the mixture of soporifics produced complete and lasting normalization of the higher nervous functions of the experimental animals.

In the case of neuroses accompanied by disturbances of the conditioned feeding reflex and the unconditioned feeding reflex, sleep under the influence of the mixture of soporifics exerted a more favorable action than did sleep under the action of barbamyl alone. After sleep there was observed a definitely improved attitude of the dogs in regard to the experimental conditions. They leaped by themselves to the machine and their unconditioned feeding reflex was restored, i.e., after sleep these dogs ate all the food offered them in the conditioned reflex room. However, their conditioned reflex activity was just as chaotic as before their sleep, and their respiration rate during the experiment was considerably higher than normal.

DISCUSSION

In evaluating the effectiveness of various aspects of medicamentous sleep it appreared that neuroses in dogs, characterized by disturbances of the course of general gray matter processes, completely disappeared after three-day sleep under the influence of barbamyl alone or under the influence of a mixture of soporifics. Neuroses characterized by disturbances of conditioned feeding reflexes could not be completely abolished, in spite of repeated application of sleep therapy, whether under the influence of barbamyl alone or under the influence of a mixture of soporifics. This fact is clearly evidence of the qualitative difference between the limited protective inhibitions of these neuroses and of the necessity of a different approach to the therapy of different aspects of neurosis in which the inhibitory process predominates.

It should also be mentioned that sleep under the influence of a mixture of soporifics has a more beneficial influence than sleep under the influence of barbamyl alone. This is evidently explained by the fact that soporifics introduced together act unequally on different parts of the central nervous system; therefore their employment brings about a simultaneous combined effect on the activity of the cortical and gray matter centers.

The use of a mixture of soporifics had this advantage, that under its influence the sedation of the experimental dogs took as a rule 20-30 minutes, while the time under the influence of barbamyl was $1\frac{1}{2}$ - 2 hours. When the mixture was employed the animals went to sleep quietly, but when barbamyl was used there was usually observed decided active excitement, especially evident in dogs of the weak and intermediate types of higher central nervous activity.

From the above data it is possible to suggest that the employment in the clinic of suitable mixtures of soporifics for sleep treatment of disturbances of the central nervous system might increase the effectiveness of sleep therapy.

SUMMARY

Complete normalization of the higher nervous function of neurotic dogs with disturbed cortical processes predominating was achieved by three-day sleep produced by barbamyl alone or in combination with chloral hydrate. If in addition to the cortical processes the unconditioned feeding reflex was also disturbed, improvement after sleep treatment lasted for only 1-2 days. Sleep induced by a mixture of drugs was more effective than that induced by barbamyl alone.

LITERATURE CITED

[1] Petrova M. K., Fiziol. Zhur. SSSR, 1946, 32, 28-33.

[2] Petrova M. K., Collected Works, 1, 1953.

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* In Russian.