

CHANGES OF CONDITIONED REFLEXES IN DOGS DURING INHALATION OF ETHER IN LOW CONCENTRATIONS

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The dynamics of conditioned reflexes during inhalation of ether have not been studied. Only one observation has been described [7], in which the electrocorticogram conditioned reflex changes were studied during the development of ether narcosis, but which did not account for the concentrations of ether inhaled, and in which a detailed analysis of the effect of the drug on basic cortical processes had not been made.

In this work we have studied the changes in the conditioned reflexes of dogs under the effect of 1 and 2% of ether in oxygen.

EXPERIMENTAL METHODS

This study was made on 5 tracheotomized dogs according to the classical Pavlovian method for alimentary conditioned reflexes. These dogs had firmly established stereotypic conditioned reflexes to a positive metronome — M_{120} (+), light, tactile stimulation and the differentiated metronome — M_{60} (—). The control determinations of the magnitudes of conditioned reflexes were made on these animals inhaling oxygen, one day previous to the application of ether. The ether-oxygen mixture was administered to the animals through bypassing the upper respiratory channels, via the opening the trachea, so that they were not aware of the presence of ether. Determinations of the concentration of ether inhaled were made continuously [3] by the method of thermal analysis. For 15 min prior to the introduction of ether the dogs breathed pure oxygen. Ether was inhaled by the dogs for 20 to 60 min. Ten to forty days were allowed to elapse between applications of ether.

A total of 26 experiments with ether and 173 experiments in which the re-establishment of conditioned reflexes was studied, were conducted.

EXPERIMENTAL RESULTS

It was established that a mixture of 1% ether in oxygen did not produce any appreciable changes in the behavior of the animals. At the same time the established conditioned reflexes became changed in old dogs (the magnitude of the conditioned reflexes to a weak stimulant, the tactile stimulus, was decreased, and the differentiation became free from inhibition (Fig. 1).

A sharp decrease in the conditioned reflex to the tactile stimulation (1.5-3 times) took place in 8 out of 17 experiments, in 7 experiments this value did not change appreciably, while in the dog Seryi, in 2 experiments, it exceeded 1.5 times the initial values. An appreciable decrease of the conditioned reflex to M_{120} (+), (1.5-2.5 times) was noted in 3 experiments. In 2 experiments (dogs Seryi and Dik), its value rose 1.5 times as compared with the control, while in the remaining 12 experiments it did not change. A sharp weakening of the conditioned reflex to light (2.5-3 times) took place in 2 experiments in the dog Pushok and in 1 experiment in the dog Dik. The total value of the conditioned reflexes during the period of the entire experiment always fell in 3 dogs (18-37% in Reks, 4-28% in Milka, and 10-30% in Pushok), as compared to the control values. In Seryi and Dik a similar lowering of the total value of conditioned reflexes (12-65%) was noted in 5 experiments out of 10. In 4 other experi-

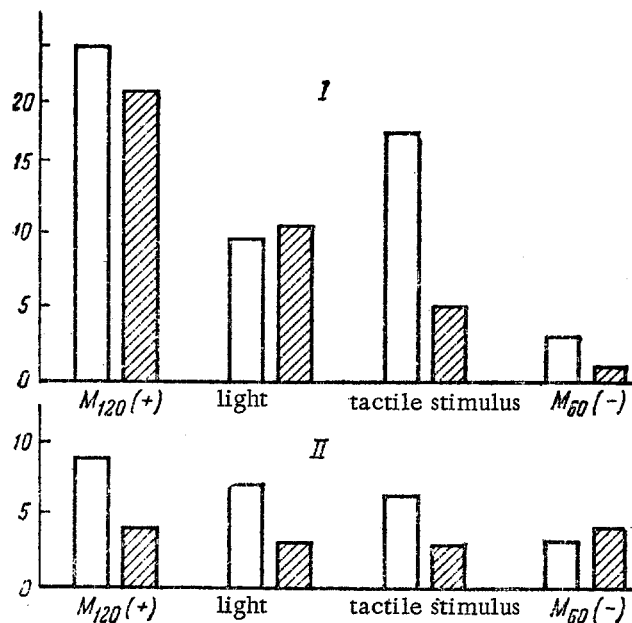


Fig. 1. Changes in conditioned reflexes during inhalation of 1% ether in oxygen. I) Dog Milka; II) dog Pushok. The magnitude of conditioned reflexes is given in the number of drops of saliva. Initial values represented by clear columns.

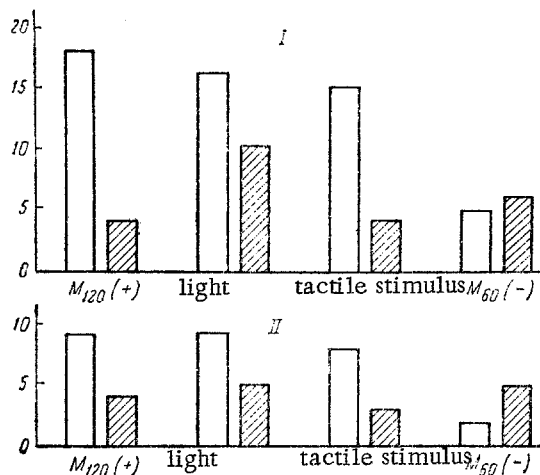


Fig. 2. Changes in conditioned reflexes during inhalation of 2% ether in oxygen. I) Dog Milka; II) dog Pushok. Legend as in Fig. 1.

the second application of 2% ether. In the dog Seryi the weakening of conditioned reflexes, accompanied by an upset of motor relationships between the conditioned stimuli in the equalizing and the paradoxal phases, was noted in one out of three experiments, at the first application of 2% ether. In two other experiments the magnitude of the conditioned reflexes to a strong stimulus, $M_{120}(+)$, and to a medium stimulus (light), exceeded the initial values, while the conditioned reaction to a weak stimulus (tactile) in one experiment was decreased by one half, and in another experiment it was not changed. In all experiments there was noted a freeing of differentiation from inhibition (1-6 drops per 30 sec).

ments the total value of the conditioned reflexes became increased 9 to 48% but it did not change in 1 experiment in the dog Seryi. The freeing of inhibition of differentiation to 1-5 drops per 30 sec of the isolated differentiation stimulant was observed in 7 experiments out of 17.

Inhalation of 2% ether had an effect on the behavior of the dogs. During the first 1-2 min the orientation reaction became developed, and later a locomotor agitation set in. The locomotor excitation became inhibited for a while, when accompanied by a loud call. However the reaction to calling by name and to the appearance of the experimenter was retained. When offered food, the dogs ate. In all the dogs there was noted a "spontaneous" salivation of 3-7 drops per minute. Under the effect of 2% ether the conditioned reflexes in the dogs Milka and Pushok became decreased in all experiments. This was accompanied by the development of equalizing, paradoxal and ultraparadoxal hypnotic phases (Fig. 2). Especially noticeable upsets of the dogs' general behavior and conditioned reflexes were noted at the first and

The restoration of conditioned reflexes following inhalation of ether occurred after 2-4 days in the dogs Reks and Pushok, after 2-7 days in Dik, after 6-10 days in Milka, and after 5-15 days in Seryi. The general behavior of dogs became normalized at once following the application of the 2% ether in oxygen mixture.

The above data show that the conditioned reflexes in dogs are altered during inhalation of relatively low concentrations of ether (1-2%) for 20-60 min, in the absence of a preliminary preparation of animals with morphine or any other drug. According to data from literature [4, 5, 6] this may be explained by a direct action of ether on the reticular substance of the brain and on the cells of the cortex [1, 2].

SUMMARY

The object of study was the dynamics of conditioned secretory food reflexes in dogs during 20-60 min inhalation of a 1-2% ether-oxygen mixture. It was found that a 1% ether mixture, without causing a change in general dogs' behavior, provokes a reduction of the conditioned reflex to a weak stimulation and disinhibition of the capacity for differentiation. The total intensity of conditioned reflexes usually declines by 4-65% below the control level. Upon inhalation of a 2% ether mixture, dogs develop a motor unrest. The conditioned reflexes are reduced in all dogs, the capacity for differentiation is disinhibited, and the ultraparadoxical and paradoxical phases come on the scene. The restoration of conditioned reflexes following inhalation of ether in small concentrations occurs on the 2nd-15th day.

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