The effect of a modulated electromagnetic field (MEMF) on experimentally evoked epileptiform activity of brain structures was studied in rats. Exposure to an MEMF with modulation frequencies of 2–30 Hz was shown to induce depression of paroxysmal brain electrical activity in 41% of experiments. Marked weakening of epileptiform activity was observed in 23% of experiments and potentiation in 10.1%. In 25% of experiments exposure to an MEMF did not significantly alter the character of evoked paroxysmal brain activity.

KEY WORDS: epilepsy; electromagnetic field; electroencephalogram; modulating frequencies.

Investigations by Bekhtereva and co-workers [1, 2] have shown that intracerebral electrical stimulation of certain deep brain structures leads to inhibition of paroxysmal electrical activity in patients.

At the same time, it has recently been shown to be possible to produce oriented changes in brain electrical activity by exposure to electromagnetic fields of radio frequencies, modulated by rhythms coinciding with the frequency characteristics of the EEG [3, 4].

In view of the urgency of the search for new methods of treatment of epilepsy, it was decided to undertake special experiments in order to study the possibility of suppressing experimentally evoked epileptiform activity of brain structures by means of a modulated electromagnetic field (MEMF).

EXPERIMENTAL METHOD

Experiments were carried out on 58 noninbred albino rats of both sexes. The animals were first tested for sensitivity to intensive acoustic stimulation in a special chamber. Animals in which acoustic stimulation evoked a violent motor response (irrelevant running, jumping), often terminating in tonic or clonic-tonic convulsions, were chosen for the experiments.

Electrodes were implanted into deep brain structures of the rats (hippocampus, amygdala, mesencephalic reticular formation, caudate nucleus, thalamic and hypothalamic nuclei), and into different regions of the cerebral cortex. Electrical activity was recorded on a BST-1 8-channel electroencephalograph and simultaneously on an "Orion" EEG analyzer. The epoch of analysis was 30 sec. In some experiments persistent epileptiform activity was obtained in the EEG of the animals by means of short-term electrical stimulation of limbic structures of the brain (hippocampus, amygdala) immediately before acoustic stimulation.

The animals were exposed to the MEMF against the background of marked epileptiform activity on the EEG. The parameters of exposure were: carrier frequency 40 MHz, field intensity 10–20 W/m, depth of modulation 80–100%, modulating frequencies 2–30 Hz. The duration of exposure varied in different experiments from 5 to 60 min.

EXPERIMENTAL RESULTS

The experiments showed that intensive acoustic stimulation evoked marked epileptiform activity in the EEG of animals predisposed to audiogenic epilepsy or in rats previously "sensitized" by electrical stimulation.
Fig. 1. Dynamics of changes in brain electrical activity of rat during acoustic stimulation and exposure to MEMF. A) Spontaneous brain electrical activity of intact rat; B) development of epileptiform activity at 6th minute of exposure to acoustic stimulus; C) suppression of epileptiform activity at 3rd minute of action of MEMF with modulation frequency of 3 Hz. 1) Sensomotor cortex, 2) dorsal hippocampus, 3) caudate nucleus, 4) mesencephalic reticular formation, 5) occipital cortex.

of the limbic structures of the brain. The activity was of two types: 1) activity of spike-wave type with different degrees of regularity, with frequencies of 1-3 Hz, and an amplitude of up to 500 μV; 2) regular hypersynchronized activity with a frequency of 4-9 Hz and an amplitude of up to 400 μV; 3) periodic bursts of paroxysmal high-amplitude waves and pointed discharges with different repetition frequencies and with an amplitude of 250-400 μV.

In 50% of experiments acoustic stimulation evoked generalized seizure activity, in 25% epileptiform activity was recorded mainly in various deep brain structures; in the remaining 25% of experiments paroxysmal activity was most marked in cortical derivations.

Exposure to MEMF against the background of continued action of the acoustic stimulus led to disappearance of the seizure activity in 41.6% of experiments. In 23.3% of experiments marked weakening of epileptiform