

# EFFECT OF EPHEDRINE AND NIKETHAMIDE ON THE OUTCOME OF MICROWAVE LESIONS IN MICE

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The rate of survival of albino mice after acute (intensity  $62 \pm 5 \text{ mW/cm}^2$ , for 11 min) and chronic (the same intensity, 6 min daily for 20 days) microwave irradiation is increased by 50% by nikethamide; ephedrine had no positive effect.

Lesions produced by microwaves have been studied from many different aspects [3, 5-7], but further analysis is required of their prevention and treatment with the aid of drugs [1, 2].

In this investigation the effect of ephedrine and nikethamide on the outcome of acute and chronic microwave lesions was studied.

## EXPERIMENTAL METHOD

Two series of experiments were carried out on 178 noninbred male albino mice weighing 24-28 g receiving whole-body microwave irradiation from the dorsal aspect by the contact method [4] with the "Luch-58" apparatus ( $\lambda = 12 \text{ cm}$ ) at an intensity of  $62 \pm 5 \text{ mW/cm}^2$ . Aqueous solutions of the drugs were injected intraperitoneally into the experimental animals (each dose was given to ten mice) in a volume of 1 ml/100 g body weight; animals of the control groups (16 mice in each series) received the same volume of distilled water.

In the experiments of series I the mice were irradiated once for 10-11 min until the onset of a terminal state (acute lesion); immediately after irradiation, ephedrine was injected in doses of 0.25, 0.5, 2, 5, and 10 mg/kg and nikethamide in doses of 10, 25, 50, 80, 100, and 500 mg/kg (calculated as nicotinic acid diethylamide), or a mixture consisting of 2 mg/kg ephedrine and 80 mg/kg nikethamide was given. The experimental animals remained under observation for 3 weeks.

In the experiments of series II the mice were irradiated for 5-6 min until the development of a state of excitation once a day for 20 days (chronic lesion); after each irradiation some animals received nikethamide in a dose of 25 mg/kg, and the others received ephedrine in a dose of 1 mg/kg. The observations on these animals began after the first session of irradiation and ended 24 h after the 20th session.

In both series the survival rate for the period of observation was determined and was used as the criterion of the effectiveness of the drugs.

## EXPERIMENTAL RESULTS

The survival rate among the mice with acute microwave lesions treated with nikethamide in doses of 50-100 mg/kg was increased by almost 1.5 times, whereas in mice receiving ephedrine over a wide range of doses it was not appreciably changed compared with the control (Fig. 1). Administration of a mixture of nikethamide and ephedrine resulted in an increase in survival of the same degree as that obtained by the use of nikethamide alone in the same dose as that given in the mixture; i.e., no summation of the effects of the drugs was found.

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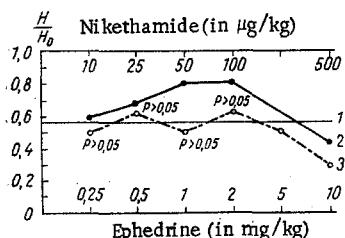


Fig. 1

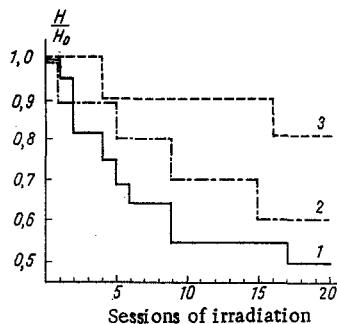


Fig. 2

Fig. 1. Survival rate of mice with acute microwave lesions in the control group (1) and in groups of mice receiving various single doses of nikethamide (2) and ephedrine (3) immediately after irradiation. Abscissa, doses of drugs (in mg/kg); ordinate, ratio between number of mice surviving 3 weeks after irradiation ( $H$ ) and number of mice alive immediately after irradiation ( $H_0$ ) for each group.

Fig. 2. Survival rate of mice with chronic microwave lesions in relation to number of daily sessions of irradiation: 1) control; 2) group of mice receiving ephedrine in dose of 1 mg/kg; 3) group of mice receiving nikethamide in dose of 25 µg/kg. Abscissa, number of daily sessions of irradiation; ordinate, ratio between number of mice surviving until last session of irradiation ( $H$ ) and number of mice at the beginning of the experiment ( $H_0$ ) for each group.

In the group of mice with chronic microwave lesions receiving nikethamide the mortality during irradiation was reduced and the over-all survival rate was increased by 1.6 times; in the group of mice receiving ephedrine, however, the increase in survival rate was very small although the death of the mice was delayed compared with the control (Fig. 2).

These results indicate that stimulation of respiration by nikethamide has a favorable effect on recovery after microwave irradiation and the survival rate is increased.

Microwave irradiation, like many other powerful stimuli outside the physiological range, probably causes exhaustion of the noradrenalin reserves to an extent proportional to the strength of stimulation. In acute lesions when ephedrine, judging from the experimental results, is virtually ineffective the exhaustion was evidently most complete; in chronic lesions, however, when ephedrine was slightly effective, the exhaustion was not so complete and the noradrenalin reserves had had time to be replenished to some extent after the last session.

Stimulation of the medullary centers thus has a favorable effect on the outcome of both acute and chronic microwave lesions. Adrenomimetic drugs with indirect action are relatively ineffective in microwave lesions.

#### LITERATURE CITED

1. V. M. Koldaev, Effect of Microwaves on Rats Exposed to Hypoxia or to Certain Chemicals. Author's Abstract of Candidate's Dissertation, Ryazan' (1970).
2. V. M. Koldaev, Farmakol. i Toksikol., No. 4, 505 (1972).
3. I. R. Petrov (Editor). The Effect of SHF Radiation on Man and Animals [in Russian], Leningrad (1970).
4. A. S. Presman, Novosti Med. Tekhniki, No. 4, 51 (1960).
5. A. S. Presman, Electromagnetic Fields and Living Nature [in Russian], Moscow (1968).
6. N. V. Tyagin, Clinical Aspects of Irradiation Within the SHF Band [in Russian], Leningrad (1971).
7. S. M. Michaelson, Am. Indust. Hyg. Ass. J., 32, 338 (1971).