Reaction of Biogenic Amines of Lymph Nodes to Electromagnetic Field of Extremely High Frequency

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Translated from *Byulleten' Eksperimental'noi Biologii i Meditsiny*, Vol. 126, No. 12, pp. 634-636, December, 1998.
Original article submitted December 05, 1997

In comparison with pain stress, electromagnetic radiation of extremely high frequency of the millimeter range increases 40- to 50-fold the concentration of biogenic amines in B- and T-dependent zones of the mesenteric lymph nodes. The supply of biogenic amines to the lymph node structures normalizes when rats were subjected to pain stress after irradiation with electromagnetic rays of low frequency.

Key Words: *lymph node; electromagnetic radiation; catecholamines; serotonin*

Electromagnetic radiation of extremely high frequency of the millimeter range (EMR EHF) has been widely used in the therapy of some diseases. This radiation produces beneficial effects on tissue reparation [5]. There is evidence that the endocrine system of experimental animals is highly sensitive to EMR EHF. The hypothalamus and pituitary gland are the most sensitive structures which react to low intensities of EMR EHF. Irradiation of the medulla oblongata area with EMR EHF modifies immune responses of the organism by changing the concentration of monoamines in the microenvironment of the thymus and the spleen [3]. The immunocorrecting effect of EMR EHF on the content of biogenic amines in these organs after stress has been demonstrated [2].

After irradiation with EMR EHF, the synthetic activity of peripheral blood nuclear cells significantly increases as well as epinephrine and norepinephrine levels in the organism, but the catecholamine concentration in the hypothalamus decreases [6].

Our goal was to study the contents of biogenic amines in the mesenteric lymph nodes of intact rats and of rats exposed to EMR EHF, stress, or both.

MATERIALS AND METHODS

Experiments were performed in October. Mesenteric lymph nodes of 39 outbred male albino rats (body weight 150-200 g) were studied. The rats were divided into four groups. Group 1 consisted of intact animals (n=14); group 2 rats were exposed to a 15-min pain stress (n=10), group 3 rats were exposed to an EHF field (wavelength 5.6 mm, 53,534$_3$10 MHz) in a Yav'-1 apparatus (n=5), and group 4 rats were stressed after exposure to EMR EHF (n=10).

Mesenteric lymph nodes were excised under ether anesthesia, cryostat sections (15-25-μ thick) were processed by modified histochemical methods [9] for visualization of biogenic amines. Intrafollicular cells, their microenvironment, the intensity and the paracortical region macrophages were studied. The intensity of catecholamine and serotonin luminescence was measured in a Lumam-4 microscope equipped with an FMEL-1A fluorimetric device (interference filter 8 and 6 for serotonin, respectively). The concentrations of biogenic amines were expressed in arbitrary units of luminescence. The significance of differences was evaluated by Student's t test.

RESULTS

After a 15-min exposure to EHF field the "luminescence" of the follicle decreased. Cytospectrofluorometry has shown that the serotonin and catecholamine contents in luminescent structures of the B-dependent area increased 60- and 40-fold, respectively. The contents of the biogenic amines also increased in paracortical macrophages.

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0007-4888/98/0012-1205$20.00

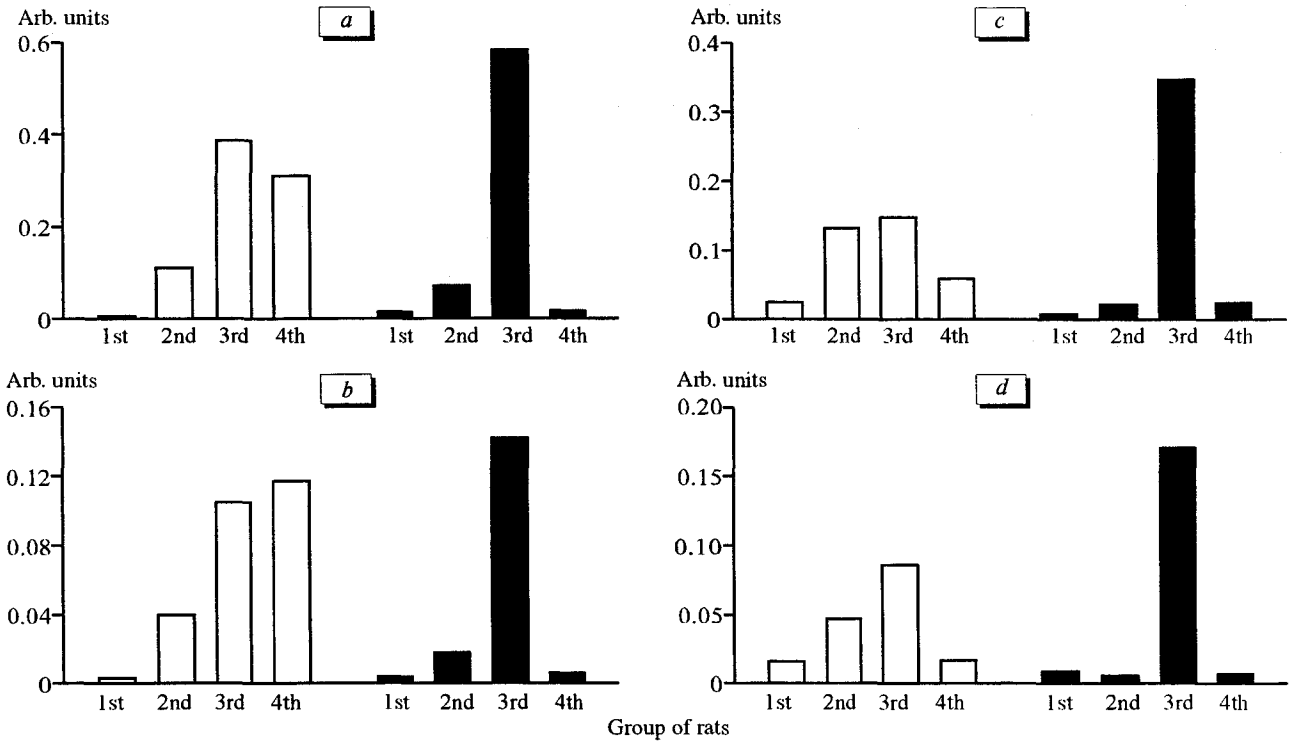

Fig. 1. Concentrations of serotonin (light bars) and catecholamines (dark bars) in the lymph node structures. Intrafollicular cells (*a*) and follicle background (*b*); paracortical cells (*c*) and their background (*d*).

Pain stress increased the serotonin and catecholamine contents in intrafollicular and paracortical cells 20- and 5-fold, respectively, in comparison with intact animals. Morphologically, this increase coincided with the rise in the number of luminescent granules in these cells.

Stress after exposure to EMR EHF led to an increase in the serotonin content of intrafollicular macrophages by 50-fold (Fig. 1) and in the T-dependent zone by 2-fold and of catecholamine by 3-fold. In the B-dependent zone macrophages the catecholamine content remained practically unchanged compared with that in intact animals. Microfluorometrically, yellow luminescence of intrafollicular cells sometimes spread over the lymph node.

Our findings are consistent with the observation that EMR EHF changes tissue homeostasis. Both pain stress and EMR EHF markedly increased the concentrations of serotonin and catecholamines in mesenteric lymph nodes (Fig. 1). The increase was much smaller in rats stressed after EMR EHF exposure.

Thus, EMR EHF increases 40- to 50-fold the contents of biogenic amines in the structures of T- and B-dependent zones of mesenteric lymph nodes. The increase in the contents of biogenic amines in intrafollicular and paracortical cells of the mesenteric lymph nodes after pain stress is smaller than that after exposure to EMR EHF. The supply of biogenic amines to the lymph node structures normalizes in rats stressed after exposure to EMR EHF.

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