

of dogs to undergo complete structural recovery, i.e., for the stabilization of adaptational changes.

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Effect of Laser Radiation Against the Background of Folliculin on the Capillaries of Rat Uterus

V. M. Chertok, Yu. P. Nedobyl'skaya, Yu. K. Nemkov, and S. A. Shakunov

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Folliculin potentiates the effect of laser radiation on uterine capillaries. Laser radiation in combination with folliculin increases the activity of exchange surface enzymes by 21% and the total length of capillary bed by 11%.

Key Words: capillaries; uterus; laser; folliculin

It has been shown that capillaries of the uterus are highly sensitive to low-intensity laser radiation (LILR) [1,3,7], which stimulates transcapillary exchange, improving tissue trophism in degenerative-dystrophic and inflammatory disorders of female reproductive system. However, potential changes in the response of uterine capillaries to LILR against the background of drugs and, particularly, hormones has been often ignored.

Our objective was to examine the reaction of capillary bed (CB) of the uterus to LILR against the background of folliculin.

MATERIALS AND METHODS

Adult albino rats ($n=40$) weighing 250 g were used. The animals were divided into four equal groups. Group I rats were given a single intraperitoneal injection of 0.2 ml sterile olive oil. Group II rats received a single intramuscular injection of folliculin (0.2 ml 0.05% oil

solution). Rats of both groups were decapitated 60 min after the injection. Group III rats were irradiated with a helium-neon laser (continuous mode, 632.8 nm, 0.76 mW/cm²). Biologically active points on the skin (F₂, XII) associated with the regulatory function of the uterus [8] were irradiated for 1 and 5 min. Group IV rats were injected with folliculin (0.2 ml 0.05% oil solution), irradiated (1 and 5 min) one hour after the injection (the maximum effect of folliculin [4]), and decapitated.

In all groups, unfixed 25- μ cryostat sections were mounted on coverslips, air-dried for 15-20 min, and analyzed for the presence of Mg-activated ATPase [9]. Standard morphometry of capillaries [5] was carried out in three fields of view, separately on each of 6 sections and for each rat.

RESULTS

In control animals, the reaction product was observed on the capillaries located in endometrium and myometrium (Fig. 1, a). The density of the capillary net-

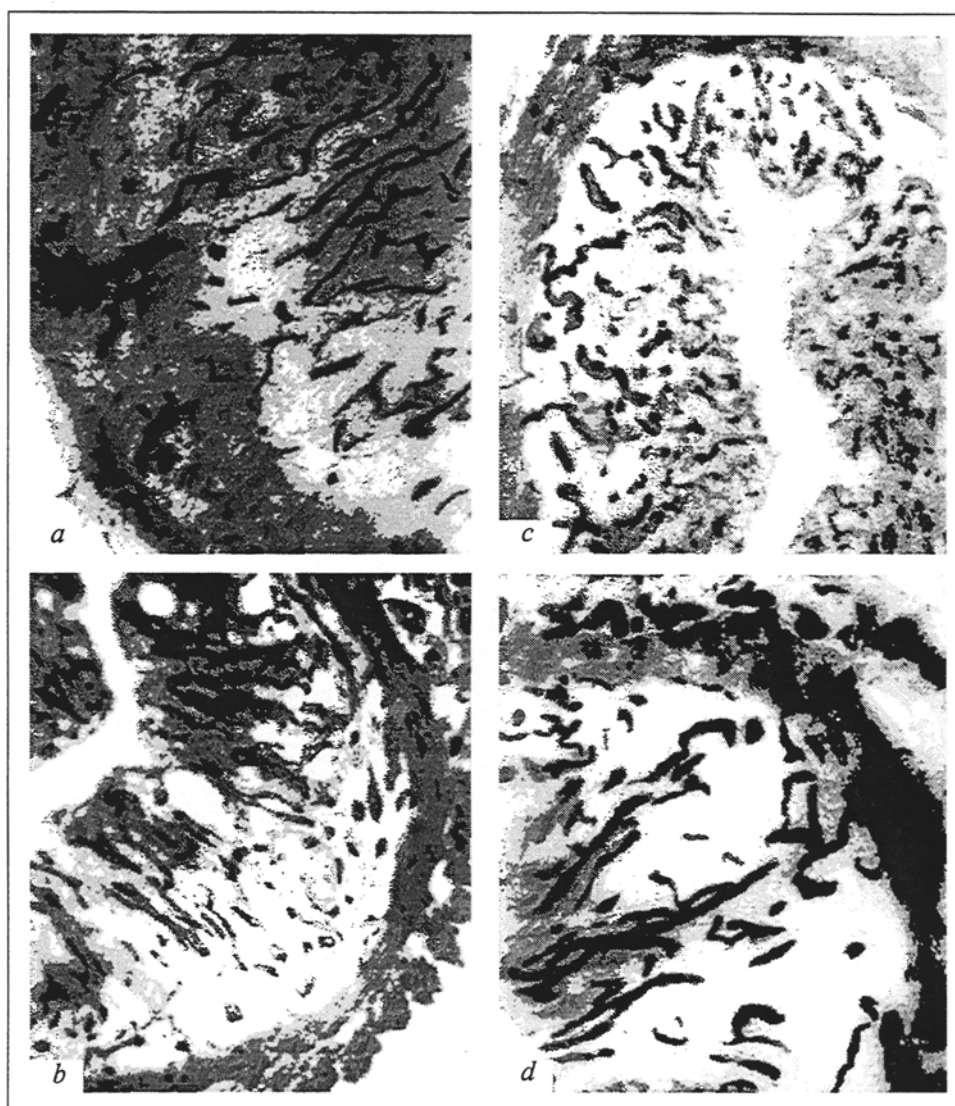


Fig. 1. Capillary bed of the uterus control (a) and experimental (b-d) rats. b) 60 min after administration of folliculin; c) after 1-min laser irradiation; d) 1-min laser irradiation 60 min after administration of folliculin. The method of Koenig and Vial. $\times 44$.

work was higher in the endometrium. Depending on the enzyme activity, the capillaries were dark brown, brown, or light brown. Blood vessels with diameter varying from 3 to 7 μ were regarded as capillaries [1,2]. On transverse sections of the uterus the capillaries looked like thin, straight, bent, or slightly convoluted tubules evenly distributed over the field of view. In most capillaries the enzyme exhibited a moderate activity.

Administration of folliculin caused noticeable changes in the uterus (Fig. 1, b). Clarified and edematous endometrium contained short capillary segments of light brown color indicating enzyme activity. Morphometry showed that the density of the precipitate and total length of capillaries decreased by 20 and $>50\%$, respectively (Table 1). Only occasional short enzyme-positive segments of capillaries were observed in the myometrium. Changes in the mean activity of enzymes (MAE) on the exchange surface of CB were most pronounced among other

parameters characterizing functional state of capillaries. Folliculin reduced the intensity of exchange processes at the blood/tissue interface by 62%, judging from the enzyme activity.

On the first minute of laser irradiation, the MAE and capillary diameter increased (Table 1). The precipitate on the vessel wall was brown or dark brown (Fig. 1, c). By the 5th min of irradiation the MAE increased by 10% and the capillary diameter by 19%. Swellings and protrusions formed on capillaries. The increase in the total length of uterine CB in irradiated rats was statistically insignificant ($p > 0.05$) compared with the control. However, the structure of the capillary network changed: the vessels became convoluted, spiral, and branched. The intensity of transcapillary exchange increased. Laser irradiation for 1 and 5 min caused a 30 and 51% increase in the MAE. Stimulation of transvascular exchange by laser radiation has been observed in other internal organs [1,6]. This

TABLE 1. Individual and Combined Effects of Folliculin and Laser Radiation on Uteral CB in Rats

Parameter	Control	Folliculin	Laser radiation		Folliculin+laser radiation	
			1 min	5 min	1 min	5 min
Enzyme activity (arb. units of light abs.)	4.51±0.13	3.63±0.23**	4.74±0.28	5.20±0.16*	4.37±0.27	4.03±0.21*
Mean capillary diameter, μ	5.06±0.21	5.21±0.34	5.98±0.19*	6.03±0.14*	5.2±0.44	5.62±0.19*
Total CB length, mm	160.5±6.4	74.3±4.2***	163.5±7.2	172.4±10.3	141.3±12.6*	143.1±12.4*
MAE, arb. units	36.6±1.4	14.1±1.8***	46.1±1.3***	54.05±1.3***	32.1±2.4*	32.4±2.3*

Note. * $p<0.05$, ** $p<0.01$, *** $p<0.001$ compared with the control.

stimulation improves oxygenation and, consequently, metabolic processes in surrounding tissues.

Laser radiation caused considerable structural rearrangements in uterine CB of folliculin-treated rats (Fig. 1, d). Clarified endometrium contained areas with numerous capillaries intensely stained for MAE. The capillaries were dilated and branched. At the same time, areas free from capillaries or with short segments of small-diameter capillaries with low or very low MAE were observed. Owing to the heteromorphous changes in CB, changes in morphometric parameters were less pronounced compared with those caused by laser radiation and folliculin separately (Table 1). After 1-min laser irradiation, statistically significant changes were observed in the total length of CB and MAE. Five-minute irradiation decreased the total length of CB by 11% and the MAE by 21.5%, while the mean diameter of capillaries increased. Similar qualitative and quantitative changes in the CB parameters were observed after irradiation of the uterus with a low-intensity (0.76 mW/cm²) helium-neon laser for 0.5–1 h or a short-term (3–5 min) irradiation at a power density of 2 mW/cm² [1,3].

Thus, pretreatment with folliculin increases the sensitivity of uterine capillaries to laser radiation, i.e.,

folliculin acts as a photosensitizing agent. Other hormones may elicit a similar effect. There is evidence that corticosteroids markedly potentiate the photodynamic effect of laser [1]. Light energy intensifies the interactions between hormones and oxygen, which results in more pronounced transformations of biological membranes.

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