Effect of Intravascular Radiation of Venous Blood on the Development of the Fever Syndrome in Rats

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Experiments on wakeful rats revealed that the second phase of hyperthermal response evoked by intraperitoneal administration of endotoxin is eliminated after intravascular irradiation of venous blood in the ultraviolet range during the first phase of experimental fever.

Key Words: *ultraviolet blood irradiation; endotoxin; fever reaction*

The area of application of ultraviolet radiation (UVR) in clinical practice persistently grows. This type of irradiation is characterized by immunostimulant, bactericidal, antitoxic, hypoglycemic, and other effects [3]. At the same time, some delicate mechanisms of UVR effects on the blood and some aspects of clinical application of this method remain obscure. Although many physiological effects of UVR are poorly understood, it has been successfully used in the treatment of various diseases for more than 70 years, and nowadays UVR is an integrate part of complex therapy [2]. Extracorporeal blood irradiation with an Izolda apparatus or its analogues is a variant of modern UVR therapy [4]. Activation of blood cell lysis the probability of infection, and increased pyrogenic activity of irradiated blood used for subsequent infusion are the drawbacks of this method. We performed blood irradiation in awake rats via a light guide of an Ivolga apparatus. The light guide was implanted into the vascular bed, which allowed us to overcome the disadvantages of extracorporal UVR.

We examined the effects of UVR on the dynamics of hyperthermal processes during experimental fever.

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MATERIALS AND METHODS

Experiments were carried out on 12 Wistar rats weighing 160-190 g, which were subdivided into 4 groups: rats with intravascular blood UVR and experimental two-phase fever induced by intraperitoneal injection of 100 μg/kg endotoxin dissolved in 0.2 ml apyrogenic saline (the first group); rats with intravascular blood UVR (the second group); rats with implanted light guide, but without subsequent UVR, which were given an intraperitoneal injection of 0.2 ml apyrogenic saline (the third group); and rats with experimental fever which were not subjected to UVR (the fourth group). The light guide was implanted into the right jugular vein under ketamine-xylazine anesthesia (respectively, 75 and 5 mg/kg intraperitoneally) 3 days prior to the experiments. The connector of the light guide was fixed to the skull bones with polymethylmethacrylate (Norakril-65). On the day of experiment the rats were placed into special cages where temperature was maintained at 30°C.

The rats were trained for 4-5 days prior to experiments under the conditions that maximally simulated the experiment. All the experiments were started at 8:30. The colonic and cutaneous temperature were monitored with copper-constantant thermocouples of an Physitemp electrothermometer. After the control parameter record (1 h), the rats of

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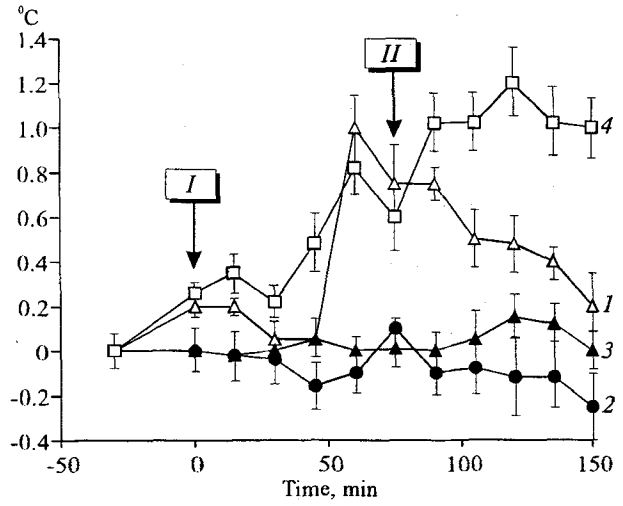

Fig. 1. Changes in the colonic temperature of rats under the effect of (*I*) lipopolysaccharide and (*II*) ultraviolet radiation. *1-4* denote the groups of rats.

the 1st and 4th groups were injected with 0.2 ml lipopolysaccharide (LPS, *E. coli* 0111:B4 LPS, Campbell) intraperitoneally in a dose of 100 μg/kg, which evoked experimental fever. After 75 min blood from the rats of the first and second groups was subjected to UVR for 7 min via the light guide. In the whole, recording of thermophysiologic parameters in all groups lasted for 5 h.

RESULTS

The rise of colonic temperature and fall in cutaneous temperature were observed in the rats of the 1st and 4th groups 40-50 min after intraperitoneal injection of LPS. After 70-80 min the increments of colonic temperature in the 1st and 4th groups were 0.77±0.20°C ($p<0.01$) and 0.60±0.17°C ($p<0.01$), respectively (Fig. 1). Irradiation of venous blood eliminated the second febrile phase observed in rats injected with a similar dose of endotoxin [1,5]. Figure 1 shows the development of the second febrile phase in the 4th groups (without UVR): the greatest increment of colonic temperature (1.2±0.25°C, $p<0.001$) was observed in this group on the 120th min of the observation period. The trend of a decrease in the core (colonic) temperature after UVR was revealed also in the rats of the 2nd group which were not injected with LPS (Fig. 1). There were no statistically significant variations of body temperature in the control rats (the 3rd group).

Thus, our results indicate that elimination of the second phase of the hyperthermal response to intraperitoneal endotoxin by intravascular ultraviolet radiation of the blood. Analysis of the antipyretic effect of UVR requires further investigations.

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