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Asymmetry of Delayed Type Hypersensitivity Reaction in Mice

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The intensity of delayed type hypersensitivity reactions in the left and right paws was studied in mice divided into left- and right-pawed by the motor asymmetry of the brain. The reaction was more pronounced in the left paw in all animals irrespective of motor asymmetry. Motor asymmetry of the brain hemispheres little contributed to the manifestation of differences in the delayed type hypersensitivity reactions in the left and right paws. The authors concluded that asymmetry of cellular immunity is determined by functional asymmetry of cells in regional lymph nodes.

Key Words: *immune system asymmetry; cellular immune response*

Many functions of the brain, including its immunoregulatory functions, depend on predominance of the left or right hemispheres [1,4,8,9]. Our findings indicate that the intensity of humoral immune response to sheep erythrocytes (SE) depends on motor predominance of the cerebral hemispheres of (CBA×C57Bl/6)F_1 mice [2,3]. Studies of other regulatory systems (immune and endocrine) also showed their functional asymmetry [4,7]. Functional asymmetry of the thymus, the central organ of the immune system, was demonstrated and the effects of asymmetry of the immune and nervous systems on the development of humoral immune response in mice were detected [3].

However, the role of asymmetry of the nervous and immune systems in the development of cellular immune response remains unclear. We studied the development of delayed type hypersensitivity (DTH) reaction in the left and right paws of (CBA×C57Bl/6)F_1 mice divided into left- and right-hemispheric by motor asymmetry.

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MATERIALS AND METHODS

Male (CBA×C57Bl/6)F_1 mice (18-20 g) from Tomsk Breeding Center were used. Motor asymmetry of cerebral hemispheres was evaluated by paw preference in a food-getting task. DTH reaction to SE was tested routinely [13]. For evaluation of lateral differences in DTH reaction, the resolving dose of SE was injected into the right and left hind paws. An equivalent volume of normal saline was injected into the contralateral paw (control).

The results were statistically processed using Student's t test.

RESULTS

Delayed hypersensitivity reaction was much more pronounced in the left paw of both left- and right-pawed animals (Fig. 1). Comparison of DTH reaction in one paw of animals differing by the use of paws when getting food showed similar intensity of reaction in both right- and left-hemispheric animals. No appreciable differences between left- and right-pawed animals were detected after injection of the resolving dose of the antigen into the right paw (Fig. 2). This

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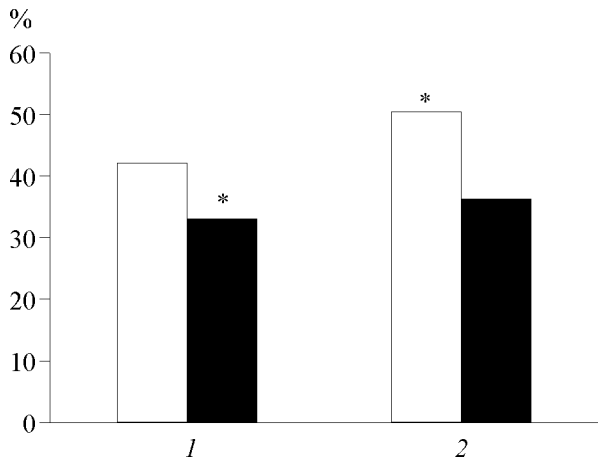

Fig. 1. Delayed type hypersensitivity (DTH, %) reaction in the left and right paws of (CBA×C57Bl/6)F_1 mice divided into right- (*1*) and left-hemispheric (*2*) by motor asymmetry. Light bars: intensity of DTH reaction in the left paw; dark bars: that in the right paw. **p*<0.05 compared to the control.

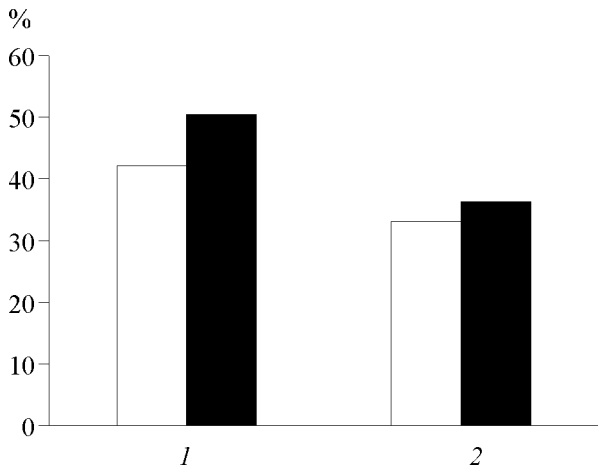

Fig. 2. Delayed type hypersensitivity (DTH, %) reaction in the left (*1*) and right (*2*) paws of right- and left-hemispheric (CBA×C57Bl/6)F_1 mice. Light bars: intensity of DTH reaction in right-hemispheric mice; cross-hatched bars: that in left-hemispheric mice.

attested to asymmetry of the immune system, which did not depend on motor asymmetry of brain hemispheres. This asymmetry of the immune system leads to the development of a more intense cellular reaction in the left paw. The formation of DTH reaction is primarily realized via regional lymph nodes [10], therefore our results indicate asymmetry in the functioning of these paired peripheral lymphoid organs.

If the predominance of this or that hemisphere does not modulate the development of DTH reaction, we can expect similar differences in the intensity of reactions not only between different paws of the left- and right-pawed animals, but also in cross variants. It was found that DTH reaction in the left paw of left-hemispheric mice significantly surpassed that in the right paw of right-hemispheric animals (Fig. 3). Hence, the predominance of cerebral hemispheres is significant for asymmetry of the cellular immune response, but its contribution to the development of DTH reactions in (CBA×C57Bl/6)F_1 mice in the left and right paws is not so manifest as the contribution of the immune system asymmetry.

According to published data, in humans DTH reaction to tuberculin develops differently on the left and right hand: tuberculin test on the left hand is always more pronounced than on the right hand [6]. Our results are in line with these data. The effect does not depend on the antigen (tuberculin or SE). However, some authors [6] do not offer any explanation of this effect. Possible causes of lateralization of cellular immune response were proposed [1,2]. In patients with ischemic stroke the diameter of tuberculin test depends on the cerebral hemisphere damaged by stroke: in individuals with damage to the right frontal lobe the reaction on the side of paresis is more pronounced than on the contralateral side [11]. The authors believe

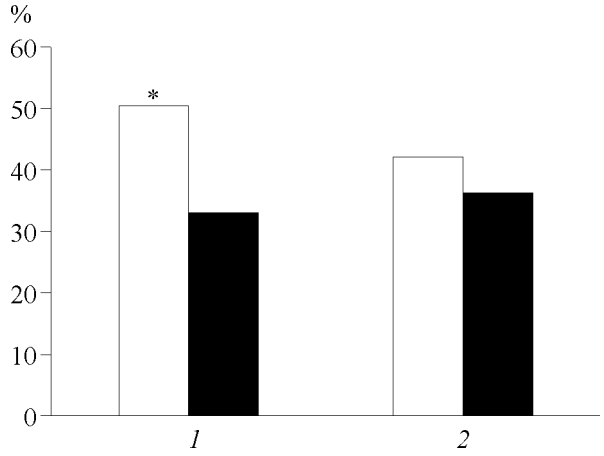

Fig. 3. Delayed type hypersensitivity (DTH, %) reaction in (CBA×C57Bl/6)F_1 mice after injection of the resolving dose of the antigen (SE) ipsi- (*1*) or contralaterally (*2*) to the dominant hemisphere. *1*) light bar: DTH reaction in the left paw of left-hemispheric animals; dark bar: DTH reaction in the right paw of right-hemispheric animals. *2*) light bar: DTH reaction in the left paw of right-hemispheric animals; dark bar: DTH reaction in the right paw of left-hemispheric animals. **p*<0.05 compared to DTH reaction in the right paw of right-hemispheric animals.

that as the immunomodulation center is located in the right frontal lobe. In another report the same authors demonstrated that in poliomyelitis tuberculin reaction was smaller on the side of paresis than on the contralateral side. They explained this asymmetry by impaired motor and sympathetic innervation on the damaged side [12]. Our data confirm that lateralization of DTH reaction in rats depends not only and not so much on the cerebral hemispheric effects, but mainly on the place of the reaction (in the right or left paw).

Hence, functional asymmetry of the contralateral lymph nodes, regional with respect to the site of developing DTH reaction, is proven, and cerebral hemispheres modulate the development of this reaction.

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