

EFFECT OF COMPENSATORY HYPERTROPHY OF THE KIDNEY ON ABILITY OF SPLENCYTES TO INDUCE A REGIONAL GRAFT VERSUS HOST REACTION

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Relations between processes of cellular immunity and regenerative growth have been investigated mainly on a model of regeneration of the liver and spleen [2, 4-11]. The functional state of the immunogenesis system during compensatory hypertrophy of the kidney has been the subject of only a few investigations [1, 3]. Nevertheless the study of the immunologic status during regenerative growth of the kidney is not only interesting on its own account, but it is of great importance for determination of differences in the immunologic response of the organism to trauma of different organs, and also for the study of various theoretical problems to do with elucidation of the causes of changes in activity of lymphoid tissue during regeneration.

The aim of this investigation was to study the effect of nephrectomy and ligation of the ureter on the functional state of lymphoid tissue.

EXPERIMENTAL METHOD

The state of function of lymphoid cells was assessed by their ability to induce a regional graft versus host reaction (GVHR). The recipients were 400 male (CBA × C57BL/6)F₁ mice, divided into groups of not less than 20 animals. As donors, 100 male C57BL/6 mice were used: some were intact, others were subjected to one of the following unilateral and bilateral operations under ether anesthesia: nephrectomy, ligation of the ureter, mock operation. The mice were killed 5, 17, 24, and 72 h after the operation by cervical dislocation and suspension of lymphoid cells was obtained from the spleen by the method described previously [4]; the suspension, in a dose of 1×10^7 cells in 0.1 ml of medium 199 per mouse, was injected beneath the plantar aponeurosis of the hind limb. An equal volume of medium was injected into the contralateral limb.

The recipients were killed 7 days after transplantation of the splenocytes. Popliteal lymph nodes were weighed on analytical scales. The intensity of the GVHR was assessed as the degree of relative excess of weight of the lymph node on the experimental side over the weight of the lymph node in the control limb, and these results are given in Table 1 as the corresponding ratio. The effect of the operation on the ability of splenocytes to induce the GVHR was estimated both from the intensity of the reaction and from the time of appearance of the first definite signs of a change in GVHR-inducing capacity of the splenocytes after the operation.

The numerical results were subjected to statistical analysis by the Fisher-Student method.

EXPERIMENTAL RESULTS

It will be clear from Table 1 that splenocytes of intact mice induced a GVHR whose intensity is reflected by the ratio of 2.10 ± 0.13 . A unilateral mock operation caused no

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TABLE 1. Changes in Ability of Splenocytes to Induce Regional GVHR after Different Operations

Time of sacrifice of donors after operation, h	Unilateral operation			Bilateral operation		
	mock	nephrectomy	ligation of ureter	mock	nephrectomy	ligation of ureter
Animals not undergoing operations	2,10±0,13	—	—	2,10±0,13	—	—
5	2,33±0,19	2,96±0,28	—	2,56±0,31	4,87±0,95	2,72±0,28
17	3,50±1,05	4,06±1,04	—	—	—	—
24	2,15±0,12	3,21±0,17	2,41±0,17	—	—	—
72	2,25±0,12	2,34±0,24	3,54±0,25	—	—	—

significant change in the GVHR-inducing properties of the splenocytes at any time of investigation. Unlike the mock operation, unilateral nephrectomy potentiated the ability of the splenocytes to induce a GVHR. This effect was clearly expressed 24 h after the operation. This fact shows that changes in the properties of the lymphoid cells are not necessarily dependent on the presence of a wound surface on the organ, for under the conditions of the operation the whole parenchyma of the kidney was removed. At other times after the operation (5, 17, and 72 h) splenocytes of unilaterally nephrectomized mice did not differ significantly from the control.

After unilateral ligation of the ureter the splenocytes also acquired the ability to induce a more intensive GVHR than splenocytes of control mice. However, the increase in activity of the splenocytes in this experiment took place later (72 h after the operation) than after unilateral nephrectomy. The presence of kidney tissue in the body, although not performing its function completely, evidently delays the response of the immunogenesis system. The original and principal causes of development of changes in properties of the splenocytes are evidently a deficiency of tissue of the organ and the relative degree of that deficiency, but later, phenomena which may perhaps alter the qualitative nature of parenchymal antigens of the nonfunctioning kidney may assume importance.

An increase in the quantity of kidney tissue removed was accompanied by acceleration of the response of the immunogenesis system. After bilateral nephrectomy an increase in the ability of the splenocytes to induce a regional GVHR appeared as early as 5 h after the operation. Bilateral ligation of the ureter, giving rise to the same disturbance of excretory functions as bilateral nephrectomy, did not affect these properties of the lymphoid cells 5 h after the operation.

The following conclusion can be drawn from these results. Compensatory hypertrophy of the kidney, like regeneration of the liver [9], is accompanied by increased ability of the lymphoid cells to induce a regional GVHR. The response of the lymphoid tissue after the operation develops mainly to deficiency of kidney tissue, and not to changes in its antigenic properties as a result of trauma to the wound surface, and in the tissue of the whole organ as a result of an increase in the functional load and preparation of cells of the residual kidney for proliferation. The response of the lymphoid tissue is preserved after total removal of kidney tissue, when the causes mentioned above are removed. Metabolic disturbances associated with insufficiency of the excretory function of the kidney also play a secondary role, because similar disturbances of this function when the kidney tissue is preserved do not induce such a rapid response of the splenocytes. Hence it follows that deficiency of the specific stimulus is just as disturbing an agent for the immunogenesis system as for other systems (nervous and endocrine).

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EFFECT OF A LOW-INTENSITY CO₂ LASER ON REPARATIVE REGENERATION OF EXPERIMENTAL WOUNDS

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Reports have recently been published on the successful use of low-intensity laser radiation in the treatment of trophic ulcers and indolent wounds [1-3, 5, 7, 8, 11]. However, parameters of laser irradiation are still determined empirically [5].

The aim of this investigation was to determine optimal power densities and exposures of low-intensity infrared laser radiation with a wavelength of 10.6 μ , which have a beneficial effect on regeneration of experimental unsterile skin wounds.

EXPERIMENTAL METHOD

Male Wistar albino rats (216) weighing 200-250 g, had a wound inflicted on the lateral surface of the thigh covering an area of 1 cm² bounded by a stencil. Half of the animals (18 in each series) after 1 day were irradiated on the "Klinika-2" apparatus, based on the LG-23 infrared CO₂ laser, daily. The remaining animals served as the control. The rats were decapitated on the 4th, 8th, and 15th days. When choosing the power density of irradiation (0.5, 4, and 20 mW/cm²) and exposure (2, 6, and 10 min), experience gained in previous investigations [6] was utilized.

The time course of wound healing was monitored by the planimetric method of Hejda and Hejdova in Rusakov's modification. Material was fixed in neutral formalin. Paraffin sections were stained with hematoxylin and eosin, by the methods of Van Gieson, Weigert, Hale, and Brachet, and with Schiff's reagent. The number of vessels and of the different types of cells was counted by means of a modified Avtandilov's grid in five fields of vision in the granulation tissue. The ratio of the number of vessels filled with blood to their total number (in %) was described as the degree of filling of the granulation tissue with blood. The main components of granulation tissue, namely collagen and glycosaminoglycans, were determined as hydroxyproline and hexuronic acid. The latter were isolated by the method of Anastasiadis and Common, followed by quantitative determination of hydroxyproline by Stegemann's method and of hexuronic acid by Dische's method.

The criterion of effectiveness of laser therapy was the aggregate of factors such as wound area, thickness of scab and granulation tissue, its structure, cell composition, and filling of its vessels with blood, and also the quantity of collagen and glycosaminoglycans.

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