

between the "quantum" of transmitter and the synaptic vesicles. The state of affairs must be noted because recently doubts have been expressed on this problem [3].

Attention may also be directed toward the high reserves of reliability of the neuromuscular junction, for despite changes in a factor as important for the regulation of synaptic processes as the calcium ion concentration, synaptic function remains adequate for performance of the vital functions, in this case respiration.

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MORPHOLOGICAL ANALYSIS OF THE EFFECT OF DESYMPATHIZATION ON INTESTINAL IMMUNE MECHANISMS

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Investigators in recent years have shown increased interest in the immunologic defense of the intestine, in preventing adsorption of foreign, including pathogenic, agents and their passage through the intestinal barrier. The main components of the effector stage of this system are the intraepithelial lymphocytes (IEL), responsible for the cell-mediated response [14], and the plasma cells, producing 7S IgA components and the j-chain of secretory immunoglobulins [13]. Synthesis of the secretory component and assembly of 7S IgA take place in enterocytes [12]. Whereas the basic principles governing the function of this system and their structural basis have been investigated in sufficient detail [4, 5, 9], the importance of the neural factor in the maintenance of its structural and functional integrity has received little study. Only lymphoid infiltration of the stroma and an increase in the number of IEL in the villi of the jejunum have been demonstrated in rats after vagotomy [3]. The role of the sympathetic division of the autonomic nervous system in the regulation of the structure and function of the immune mechanisms of the intestine, however, has not been investigated. Yet the elucidation of this problem is of definite theoretical and practical interest, first, for a deeper understanding of the pathogenesis of neurodystrophic processes and, second, in connection with the use of operations involving disturbance of the sympathetic innervation of the intestine in clinical practice [7].

On the basis of the facts described above, it was decided to study the state of the effector components of the immunologic defense system of the small intestine and its epithelium after surgical desympathization.

EXPERIMENTAL METHODS

Experiments were carried out on 72 noninbred male albino rats weighing 200-220 g. Periaarterial sympathectomy was performed on the cranial mesenteric artery of 36 of them and the remaining animals served as the control. The effectiveness of intestinal desympathization

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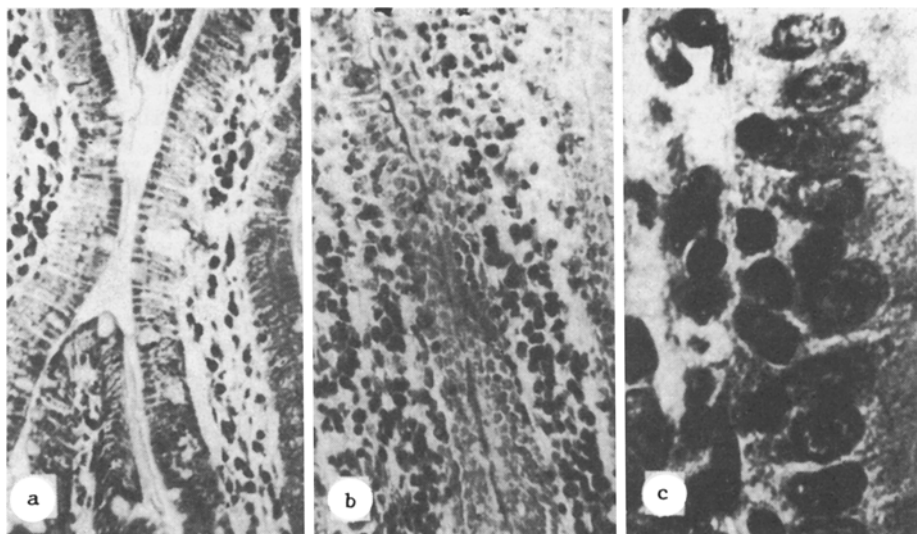


Fig. 1. Changes in number of lymphocytes in epithelium of intestinal villi and lamina propria after desympathization. a) Intact rats, b) 3 days after desympathization, c) 14 days after desympathization. Stained with hematoxylin and eosin. Magnification: a, b) 100, c) 450 \times .

was verified by luminescence-histochemical and biochemical methods, as described previously [11]. The animals were killed in pairs (experiment-control, at least six pairs at each time) 1, 3, 7, 14, 30, and 90 days after the operation, and 18-24 h after the last meal. Regions of the proximal part of the jejunum were fixed in Carnoy's fluid and embedded in paraffin wax. The number of IEL was counted in sections stained with hematoxylin and eosin and the thickness of the epithelium was measured in the upper and middle thirds of the villi. In sections stained with methyl green and pyronine, the number of plasma cells and lymphocytes in the lamina propria of the mucous membrane was determined by means of an ocular grid. The significance of differences between the experiment and control was assessed by the Fisher-Student method. To determine functional dependence between the parameters studied, correlation analysis was used. Rank correlation coefficients were calculated by the traditional method [10] on the ACBT-40-30 computer by the program in [8].

EXPERIMENTAL RESULTS

The results showed that desympathization leads to an increase in the number of IEL in the intestinal villi throughout the period studied, and the increase was greatest between the 3rd and the 30th days. The IEL showed a tendency to form focal concentrations (Fig. 1c) which, according to some workers [15], mark foci of immunologic reactions. Lymphocytes in the lamina propria of the mucous membrane followed a different time course under these conditions: there was no difference from the control 1 day after the operation, their number was increased by the 3rd day (Fig. 1b), and thereafter it fell steadily, to reach the control level on the 30th day and falling to a minimum after 90 days. The number of plasma cells in the lamina propria likewise did not differ significantly from the control after 1 day, it showed a marked increase by the 3rd day, fell almost to the initial level on the 7th day, and thereafter increased again to reach a maximum after 90 days. The time course of the thickness of the epithelium on the upper third of the intestinal villi was similar in character but opposite in phase: after some increase on the 1st day, a decrease was observed after 3 days, and this was followed by a return to the control level, and then a further fall, and it remained depressed until the end of the period studied. Correlation analysis demonstrated definite functional dependence between some of the parameters investigated. For instance, negative correlation was found between the number of IEL and plasma cells, on the one hand, and the thickness of the epithelium on the villi, on the other hand (after 90 days $r = -0.83$ and $r = -0.94$ for the 1st and 2nd parameters respectively).

The general conclusion can be drawn from these data that when the sympathetic innervation of the intestine is disturbed, the thickness of the epithelium on the villi is reduced and this is accompanied by an increase in the number of IEL and plasma cells in the lamina propria of the mucous membrane. These changes are wavelike in character and are most conspicuous 3, 30, and 90 days after desympathization. The fact that the decrease in thickness of the

intestinal epithelium correlates with an increase in the number of IEL and plasma cells in the stroma suggests that this phenomenon may perhaps be based on strengthening of antigenic stimulation from the intestinal lumen, due to increased permeability of the epithelium. It is also very probable that the neurodystrophic process developing in the jejunum is accompanied by distortion of the antigenic structure of the epitheliocytes (and also, perhaps, of other components), which leads to the onset of an autoimmune response, such as is observed, for example, in muscle tissue when its innervation is disturbed [6].

The investigation thus showed that when the sympathetic innervation of the small intestine is disturbed the system of immunologic defense and, in particular, its effector components, is activated. This is manifested as an increase in the number of IEL in the villi and in the number of lymphocytes and plasma cells in the lamina propria of the mucous membrane.

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