ESTIMATION OF THE NUMBER OF MAST CELLS IN DIGESTIVE ORGANS OF RATS AND FROGS

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The method of determining the concentration of mast cells in all tissues of an organ as described gives statistically correct values. The use of this method has shown that the concentration of mast cells within the confines of one morpho-functional zone in organs of the digestive tract of rats and frogs is constant. In the tongue it is the same both along the length of the organ and in symmetrically opposite parts. The concentration of mast cells falls from the tongue toward the stomach.

KEY WORDS: mast cells; digestive tract.

Most workers count the number of mast cells in a certain area of a film preparation of connective tissue or a section through it. Difficulties of selective investigation of connective-tissue layers have led some workers to count these cells per unit volume of an organ, to include all its tissues [2, 4-6]. Since mast cells serve the whole complex of an organ [1], it is logical to determine their bulk concentration. The tongue, esophagus, stomach, and small intestine of rats (Rana amurensis) and served as the test object. The material was fixed by Hamperl's method and embedded in paraffin wax, after which serial transverse sections (10 μ) were cut and stained with basic brown at pH 1.0. The mast cells were counted under a microscope (objective 40×, ocular 7×) with a square ocular diaphragm, bounding an area of 0.09 mm^2. A complete section through the organ (including all its tissues) was scanned. Six sections from each organ, taken at intervals of 120 μ, were counted. The numerical results were calculated relative to the volume of one field of vision (0.0009 mm^3) and analyzed by the Fisher–Student method.

The most important problem in developing the technique is determination of the smallest acceptable size of the sample to ensure reliability. Counting 20 sections through the tongue from one rat over a distance of 3 mm showed that the mean number of mast cells in individual sections varies within narrow limits. The value of M ± m for 6-7 sections was virtually the same as M ± m for 20 sections. It is important to emphasize also that the mean concentration of mast cells remains constant throughout the portion of the organ studied and is the same in the two halves of the tongue.

Numerical indices (M ± m) of the concentration of mast cells in individual rats were statistically absolutely correct. The mean error in the tongue and in the walls of the esophagus and stomach was small (not more than ± 10%). The result of calculation of the mean indices for the whole group of animals also was completely acceptable (Table 1).

The mean error of counting in frogs also did not exceed ± 10% (Table 2). The mean indices for the group for the separate organs became appreciably less reliable in the direction from the tongue to the intestine. Extreme variants could not be excluded by sampling in the small intestine in accordance with the triple sigma rule.

Analysis of the results shows that the concentration of mast cells in the wall of the digestive tract decreases in the direction of the passage of food. In rats the index for the esophagus is 2.7 times, and in the stomach 7.2 times lower than in the tongue. In the small intestine differentiated mast cells are in

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TABLE 1. Concentration of Mast Cells in Organs of Digestive Tract in Rats (M ± m)

Animal No.	Tongue	Esophagus	Stomach	Small intestine
1	4,10±0,10	1,26±0,03	0,61±0,03	Solitary
2	3,63±0,15	1,57±0,05	0,63±0,02	»
3	4,05±0,09	1,66±0,04	0,64±0,03	»
4	4,81±0,06	1,56±0,08	0,56±0,04	»
5	4,45±0,21	2,02±0,10	0,56±0,05	»
6	4,93±0,15	1,60±0,05	0,61±0,06	»
Mean	4,33±0,20	1,61±0,10	0,60±0,01	Not determined

TABLE 2. Concentration of Mast Cells in Organs of Digestive Tract in Frogs (M ± m)

Animal No.	Tongue	Esophagus	Stomach	Small intestine
1	18,43±0,71	2,85±0,23	1,46±0,08	1,91±0,09
2	22,47±0,71	5,06±0,22	1,44±0,10	3,04±0,18
3	16,85±0,46	3,52±0,19	2,17±0,13	3,23±0,21
4	17,28±0,86	5,85±0,18	2,05±0,11	3,78±0,26
5	19,19±1,06	5,10±0,23	2,96±0,11	6,15±0,58
6	18,25±0,40	5,78±0,10	3,83±0,25	4,23±0,10
Mean	18,75±0,82	4,69±0,50	2,32±0,37	3,72±0,57

general found only singly throughout the section of the organ. The mean concentration of mast cells in the same organs of frogs is 3-4 times greater than in rats. However, the proximal-caudal gradient is found in these animals also. Only in the small intestine was the concentration of mast cells greater than the stomach (by 1.6 times), unlike in rats.

Differences in the concentration of mast cells in animals of different species can be attributed to several causes, foremost among which are the character of metabolism and degree of differentiation of these cells [1]. The decrease in concentration of mast cells in the direction of the passage of food may be connected with the opposite dynamics of the mucous cells of the intramural glands. The increase in the concentration of mast cells in the small intestine of frogs does not contradict this rule, for the number of goblet cells, stained with basic brown, is much less in this organ in frogs than in rats. In addition, the number and degree of differentiation of mast cells increase with increasing distance from the epithelial layer [1], to reach a maximum in the muscular layer of the organs (most highly developed in the tongue). The number of mast cells is also inversely proportional, on the one hand, to the concentration of tissue eosinophils and, on the other hand, to the degree of vascularization of the organ [3].

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