TOPOGRAPHY OF SMALL INTENSIVELY FLUORESCENT (SIF) CELLS IN THE LUMBAR GANGLIA OF THE RAT SYMPATHETIC TRUNK

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Small intensively fluorescent (SIF) cells in the tissue of ganglia of the autonomic nervous system are distributed among nerve cells and are also found in direct contact with blood vessels [7]. The way in which the localization of nerve cells in ganglia depends on the regions of innervation [3] and the character of distribution of blood vessels within the ganglia [6] necessitated the mapping of concentrations of SIF cells and also single SIF cells within the volume of ganglia. The topography of SIF cells has been established in the cranial cervical sympathetic ganglion [4] and intramural atrial ganglia of rats [1] and in the paravertebral ganglia of some amphibians [5].

This paper describes an analysis of the distribution of SIF cells in the lumbar sympathetic ganglia based on luminescence-microscopic study of monoamines after the condensation reaction with paraformaldehyde.

EXPERIMENTAL METHOD

Ganglia of the sympathetic trunk of Wistar rats were analyzed. Under pentobarbital anesthesia (40 mg/kg) the animal was perfused through the left ventricle with FAGLU mixture, containing 4% paraformaldehyde and 1% glutaraldehyde in 0.1 M phosphate buffer, pH 7.3 [2]. Altogether 10 rats were used. After incubation for 12-15 h in FAGLU mixture, the lumbar ganglia, oriented in gelatin blocks, were frozen and placed in a cryostat. Serial sections 10-12 μm thick were mounted in glycerin and examined in the luminescence microscope, with excitation wavelength of 405 nm and with ZhS-18 and ZhZS-19 cutoff filters. The position of the SIF cells was mapped on the sections and this was followed by reconstruction in the plane of cross section of the ganglion. For part of the analysis total preparations of ganglia placed between coverslips were studied. The cross section of the ganglion was divided into zones (Fig. 1), and the frequency of discovery of SIF cells in them was determined, after which differences in this parameter for zones 1-4 and zone 5, where the frequency of SIF cells was minimal, were estimated, using Student's t test.

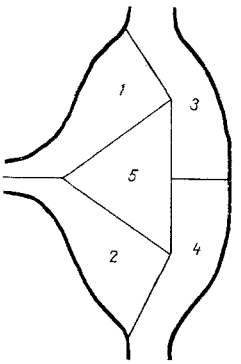

Fig. 1. Scheme of distribution of cross section of ganglia into zones.

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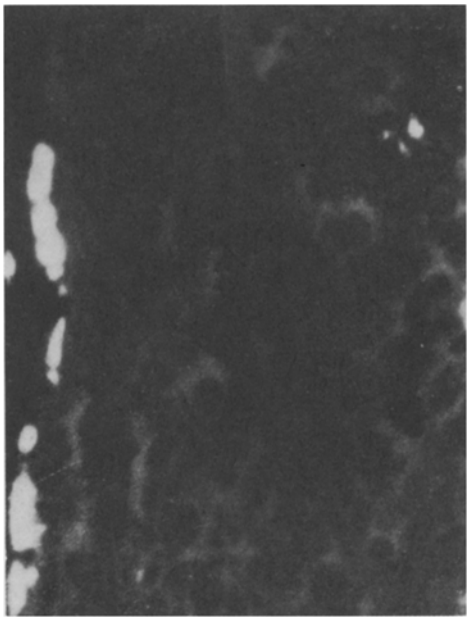

Fig. 2. Cluster of SIF cells beneath capsule of ganglion and single SIF cells in ganglion L_4 of sympathetic trunk (200×).

TABLE 1. Differences in Frequencies of Discovery of SIF Cells in Zones 1-4 (Fig. 1) Compared with Zone 5 in Lumbar Sympathetic Ganglia, Determined by t Test (t = 3 corresponds to level of probability of significance 0.99, t = 2 to 0.95, t = 1.64 to 0.9 level)

Ganglion	Zone			
	1	2	3	4
L_2:				
right	2,00	0,20	3,60	3,18
left	0,99	3,79	1,47	0,73
L_3:				
right	3,60	1,83	2,59	1,56
left	1,24	3,92	3,64	2,31
L_4:				
right	1,55	0,46	2,99	3,17
left	3,79	1,15	3,79	2,27

EXPERIMENTAL RESULTS

Variation both of morphological parameters and of the number of ganglia was observed in the lumbar region of the sympathetic trunk. Usually from four to seven ganglia were found on each side. Four or five of them were most prominent. The remaining ganglia consisted of relatively small collections of nerve cells along the course of the sympathetic trunk. The pool of SIF cells in the lumbar ganglia was formed by single cells and by concentrations or clusters of cells. In all the ganglia investigated this last type was dominant. According to the data of luminescence microscopy, the SIF cells were 6-10 μm in diameter. The intensity of fluorescence of the cytoplasm was high, but the nucleus usually could not be seen. Both in single cells and in cells forming clusters, processes could sometimes be traced (Fig. 2). Cells in clusters were very closely packed. Only at the periphery of the cluster was the morphology of individual cells clearly visible (Fig. 3). The clusters contained between 3-4 and 12-15 cells. The largest clusters were found usually close to the capsule of the ganglion. In such cases it was possible virtually always to observe a connection between the clusters and blood vessels of the ganglion (Fig. 3). Clusters containing a few cells, and also single cells, were arranged among the nerve cells of the ganglion. Identification of small vessels in these regions was difficult. In some preparations SIF cells could be seen along the course of nerve fibers of the rami communicantes and sympathetic trunk. Usually a small concentration of nerve cells accompanied the SIF cells within a bundle of fibers.

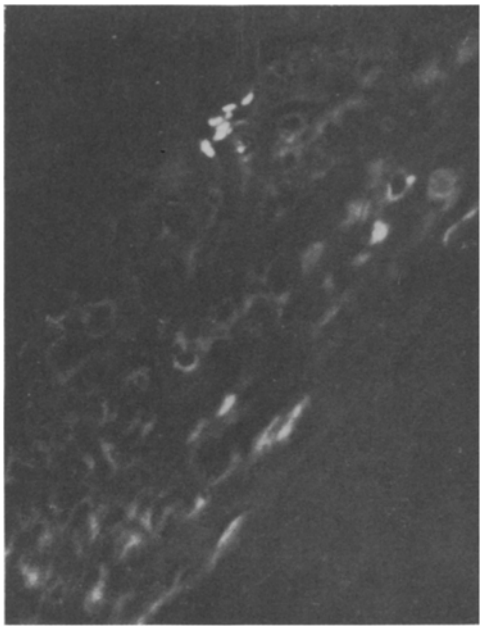

Fig. 3. Cluster of SIF cells in tissue of ganglion L_3 of sympathetic trunk (100 ×).

On average the number of SIF cells in ganglia of the right chain was 47 ± 22 for L_2, 36 ± 20 for L_3, and 51 ± 26 for L_4; the corresponding numbers in ganglia of the left chain were 43 ± 12, 35 ± 9, and 47 ± 9. Small ganglia contained fewer SIF cells (usually 5-9). Differences in the average number of SIF cells of corresponding ganglia of the right and left sympathetic trunks were not significant, for individual variability of this parameter was high (in all cases, $P > 0.05$).

Analysis of projections of the locations of SIF cells on the cross section of the lumbar ganglia revealed the following patterns. In the region of exit of the rami communicantes SIF cells were found only in the second ganglia. The distribution of SIF cells by zones in these same ganglia was more uniform, whereas in cross sections of ganglia L_3 and L_4 zones where most SIF cells were distributed could be distinguished (Table 1). These zones usually corresponded to the positions of the largest clusters of SIF cells, located beneath the capsule of the ganglion.

It is difficult on the basis of the results of this investigation to correlate the pattern of distribution of SIF cells with the character of the microcirculation or with the regional principle of organization of nerve tissue in the ganglion. At the same time, the high constancy of discovery of SIF cells in several zones of the ganglia will be noted; together with the considerable attention which has been paid to the study of ganglionic transmission in them, this makes this object a convenient one for the study of relations between SIF cells and the other tissue elements of nerve ganglia.

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