INTERNAL STRUCTURE OF THE CERVICAL SYMPATHETIC TRUNKS OF THE RABBIT

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UDC 611.839.1-018.019+599.325.1-148.3:591.86

The question of the internal structure of the cervical sympathetic trunk as it approaches the superior cervical sympathetic ganglion arose in connection with extensive electrophysiological investigations of the ganglion in rabbits in the course of ontogenesis, conducted during recent years [1, 2, 6, 7]. Very little information on this subject can be found in the literature. The cervical part of the sympathetic nerve of the rabbit is known to contain two ganglia: the stellate and the superior cervical ganglia. Sometimes, as an exception, an accessory anomalous ganglion is present in the middle part of the neck or immediately above the stellate ganglion. After studying the structure of the cervical sympathetic trunks in different animals, N. S. Sevbo [4] described two types of structure. The first type, in which the sympathetic nerve concentrated its cell masses in large and widely separated ganglia, was characterized by absence of individual, scattered cells along the course of the trunk and by well marked isolation of the bundles of nerve fibers composing the trunk. In the second type of structure clusters of cells resembling ganglia were dispersed along the whole course of the cervical sympathetic trunk.

The object of this investigation was to study the morphological features distinguishing the structure of the cervical sympathetic trunds of the rabbit.

EXPERIMENTAL METHOD

The test object was the right and left cervical sympathetic trunks of rabbits. The trunks were taken for their whole length—from the stellate ganglion to the superior cervical sympathetic. Altogether seven trunks were studied, from animals aged between 3 months and 1.5 years. The trunks were fixed with formalin and embedded in celloidin. Stepwise series of transverse sections were made from the cranial, caudal, and central parts of the trunks. The thickness of the sections was 20 μ. Each 5th-10th section was stained by the Weigert—Pal method as modified by Kulchitsky. In the transverse sections the course of the bundles, their size and structure, the distribution of the medullated fibers, and the presence of cells in the columns were studied. The diameter of the transverse sections of the trunks and bundles, and the amount of epineurium and endoneurium were measured by the method suggested by A. N. Maksimenkov [3]. From the results obtained, schemes of the internal structure of the cervical sympathetic trunks were compiled. The medullated fibers were counted throughout the area of the transverse section, and the diameter of the medullated fibers were measured together with the myelin sheath by means of an ocular micrometer.

EXPERIMENTAL RESULTS

The internal structure of the cervical sympathetic trunks of the rabbits varied considerably. All the fibers of the preganglionic trunk were distributed in bundles. Along the course of the trunk a constant reorganization and regrouping of the bundles was observed. At one level of the trunk, several bundles were observed. At one level of the trunk, several bundles joined together to form one large bundle, and conversely, one large bundle split up into several smaller bundles. Regrouping of the bundles along the course of the trunk occurred every 0.3-0.6-1.5 and 2.5 mm (Fig. 1, a-c). Individual bundles of fibers could be identified for a considerable distance, not splitting up into smaller bundles or receiving branches from other bundles for distances of, for example, 2.5-8 mm.

The number of bundles forming the trunk varied at the different levels from 1 to 10. They included 1-3 large bundles from 71 to 150 μ in diameter, 1-3 medium—sized bundles from 51 to 71 μ in diameter,

Laboratory of Development of the Autonomic Nervous System, I. M. Sechenov Institute of Evolutionary Physiology and Biochemistry, Academy of Sciences of the USSR, Leningrad (Presented by Academician V. N. Chernigovskii). Translated from Byulleten' Éksperimental'noi Biologii i Meditsiny, Vol. 63, No. 5, pp. 110-113, May 1967. Original article submitted September 27, 1965.

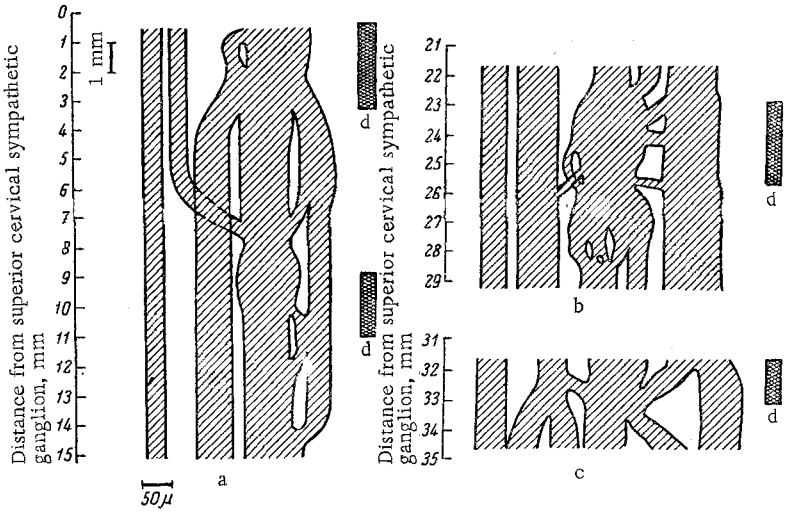

Fig. 1. Scheme of the internal structure of different parts of the cervical sympathetic trunk of a 3-month old rabbit: a) cranial part of the trunk; b) middle part; c) caudal part; d) part of the trunk with scattered cell groups.

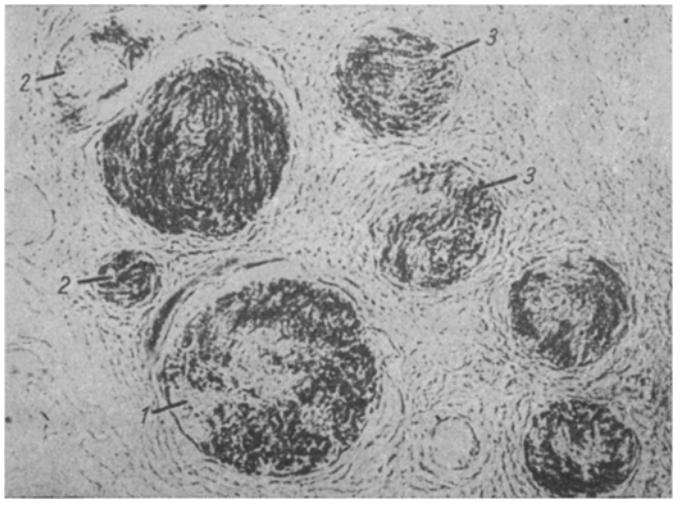

Fig. 2. Transverse section through the cervical sympathetic trunk of a rabbit aged 9-10 months: 1) large bundle; 2) small; 3) medium sized bundle. Weigert–Pal, Kulchitsky's modification. 5×40.

and 1-5 small bundles less than 50 μ in diameter (Fig. 2). Most of the bundles were round in section. Every bundle of the cervical sympathetic trunk of the rabbits consisted of a certain number of still smaller divisions, or fasciculi, separated from one another by a thin layer of perineurium, and undergoing rearrangement along the course of the trunk. In the large bundles the number of these fasciculi sometimes reached 32.

During the investigation of the crossing of the medullated fibers from one bundle to another it was observed that initially they remained independent in the bundles. In one or several bundles, one such group of fibers became increasingly separated by perineurium from the main bundle into an independent bundle, which eventually acquired its own epineurium. This bundle of fibers sometimes changed its position in the trunk, and then departed toward another bundle, which it later joined.

The maximal thickness of the layer of epineurium between the bundles varied from 37 to 65 μ and the minimal thickness from 2 to 17 μ. The maximal thickness of the layer of the outer epineurium varied from 24 to 65 μ, and the minimal from 4 to 17 μ. The diameter of the transverse sections of the cervical sympathetic trunks of the rabbits investigated varied from 200 to 335 μ.

The medullated fibers of the cervical sympathetic trunk of the rabbits were of small caliber, mainly 2-3 μ or less than 2 μ in diameter. The number of medullated fibers was considerably reduced in these section of the trunk. It may be postulated that the medullated fibers lost their sheath as they approached the cells.

Besides the cells of the groups described above, near the ganglion large clusters of cells were very often seen along the course of the cervical sympathetic trunk of the rabbits, in its cranial, middle, and caudal parts. This corresponds to the second type of structure of the trunk as described by N. S. Sevbo [4].

So special methods were used to stain the cells. Examination of the sections under the microscope soon after they had been cut, without staining or mounting in balsam, sometimes revealed cells with two nuclei and nucleoli, indicating that they were typical cells of the sympathetic ganglia of the rabbit.

In sections stained by the Weigert–Pal method with inadequate differentiation, when the yellowish background was still present, the cytoplasm became chestnut in color, while the vesicle-like nucleus was colorless or pale, and the darkly stained nucleolus stood out clearly against its background. Cells with two nuclei were also found among these groups. The arrangement of the neurons along the whole length of the lateral sympathetic trunk was described earlier by B. A. Favorskii [5]. In serial sections he found that some of the preganglionic fibers terminated by synapses in the cells of the lateral trunk.

The distinctive features of the internal structure described above were the most characteristic of all the cervical sympathetic trunks of the rabbits investigated.

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