the lumen of the capillary, and micropinocytotic vesicles of varied diameter, could be seen in them. This state of the endothelial cells of the capillaries evidently improves the blood supply to the organ and intensifies the transport of materials and oxygen through the vessel wall.

These investigations into the structure of the argali heart thus showed the presence of an increased number of capillaries around the cardiomyocytes, absence of marked hypertrophy of the myocardial cells and their organelles, and thickening of the Z-lines of the myofibrils; these are the distinguishing features of the structure of the myocardium in argali, animals with great adaptive reserves which can stand high-altitude hypoxia.

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STUDY OF THE ARGYROPHILIC STRUCTURES OF THYMUS CONNECTIVE TISSUE AFTER EXPOSURE TO X-RAYS

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KEY WORDS: thymus; reticular tissue; argyrophilic structures; irradiation.

A study of the internal medium of the thymus, in the microenvironment of which the thymocytes differentiate, is of considerable interest. In embryogenesis the thymus is laid down as an epithelial organ, but later, in the course of organogenesis, mesenchymal cells penetrate into the parenchyma to form the stroma of the thymus: interlobular septa, vessels, and capsule [1, 5, 11]. These structures are formed of reticular and loose and dense connective tissue. The epithelial cells of the thymus, bordering on connective-tissue structures, are disposed on the basement membrane [9, 10]. As a result of light-optical and electron microscopic studies, besides cells of the epithelial reticulum, cells of connective-tissue nature forming reticular tissue have been described in the internal medium of the lobule. As well as reticular cells, it contains macrophages and lymphoblasts. The macrophages of the thymus have been shown to have the power of phagocytosis [1, 2, 6].

Studies of the connective-tissue framework of the thymus have shown that there are extremely few argyrophilic fibers in both its cortex and its medulla. They mainly form the basis for the walls of blood vessels, they virtually do not extend into the medullary zone, and they do not reach the Hassall's corpuslces [1, 5].

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However, under normal conditions many tissue structures of the thymus are masked by the numerous lymphoid components; for that reason, when studying the reticular and epithelial tissues of the thymus some workers have used methods and, in particular, x-ray irradiation of animals, whereby forced emigration of lymphocytes is induced and the organ can rid itself of most of them [3, 5, 9]. After irradiation, as these workers have found, the epithelial tissue of the thymus preserves its structure for a long time. As regards the connective-tissue components and its paraplastic formations, the appropriate information is not available.

The object of this investigation was to study argyrophilic structures of the connective tissue of the thymus: histiocytes (branching macrophages) and reticulin fibers after emigration of most of the lymphocytes from the organ as a result of x-ray irradiation of animals.

EXPERIMENTAL METHOD

Experiments were carried out on 10 intact and 16 experimental guinea pigs, the latter receiving whole-body x-ray irradiation in a dose of 1000-3000 rads. The animals were killed by ether at various times between 24 and 72 h after irradiation. Pieces of the thymus were fixed in 10% formalin. Sections 10-15 μ thick were cut on a freezing microtome. Some sections were stained with hematoxylin and eosin, and the rest were impregnated with silver in order to detect histiocytes by Beletskii's method [7] and to detect reticulin fibers by Gomori's method [8].

EXPERIMENTAL RESULTS

In sections through the thymus of intact guinea pigs stained with hematoxylin and eosin clear division of the lobules was observed into cortex, rich in lymphocytes, and medulla, less rich in these cells. In the medullary layer there were numerous clearly defined laminar epithelial formations (Hassall's corpuscles). In sections through the thymus of guinea pigs killed 24 h after irradiation, massive emigration of lymphocytes from the cortex and medulla was found. Sometimes in such sections, single large dilated tissue sinuses, the walls of which were formed by reticular cells, filled with lymphocytes, could be seen at the boundary between the layers. Lymphocytes also could be seen in the lumen of the small blood vessels in the cortex of the lobules. After 36-48 h only a few dying lymphocytes, the nuclei of which were undergoing pycnosis and karyorrhexis, still remained in the territory of the cortical layer. At these times no growth disturbances were observed in the morphology of the reticular and epithelial cells. By 72 h the organ consisted practically entirely of structures composed of reticular and epithelial tissues. At this period after irradiation the nuclear chromatin of the epithelial cells formed small clumps, indicating the initial stage of karyorrhexis. The nuclei of the reticular and other connective-tissue cells were not changed in this way. In the medulla at this time many hemocytoblasts of the lymphoid series appeared in the region of the Hassall's corpuscles. Silver impregnation of reticulin fibers by Gomori's method revealed the argyrophilic stroma of the organ in sections of the thymus of animals killed 24-48 h after irradiation. The thickest fibers could be seen in the capsule and interlobular septa of the organ; thin fibrils were found in the form of delicate network in the medullary zone of the lobules (Fig. 1a). They reached as far as the Hassall's corpuscles, often surrounding them on all sides (Fig. 1b). In the cortex, argyrophilic structures were present mainly in the walls of the radially distributed blood vessels, crossing the zone and running from the interlobular septa into the medulla (Fig. 1c). Impregnation of sections of the thymus, rich in lymphocytes, from intact animals revealed only the thickest argyrophilic fibers of the stroma of the gland. By silver impregnation of histiocytes by Beletskii's method, in sections through the thymus of animals killed 24-72 h after irradiation, histiocytes (branching macrophages) and recticular cells, arranged singly or in groups over the whole territory of the lobules of the gland, could be seen. The largest groups of histiocytes were found in the zone of the Hassall's corpuscles (Fig. 1d, e). The histiocytes had a hypertrophied cytoplasm and many thickened, branching processes. No argyrophilic structures could be seen on the territory of the Hassall's corpuscles, although in individual cases they directly surrounded these corpuscles (Fig. 1e). In sections of the thymus of intact animals impregnated with silver, argyrophilic cells could virtually never be seen. Most reticular cells and histiocytes were evidently masked by the mass of lymphocytes.

The results thus indicate that argyrophilic stromal components of the connective tissue of the thymus, namely histiocytes and reticular cells, like the epithelial cells of the gland, are fairly resistant to the action of x-rays and preserve their argyrophilic properties after irradiation in large doses. The paraplastic structures in irradiated animals, having been demasked as a result of emigration and death of lymphocytes, are revealed more completely. The marked hypertrophy and proliferation of the reticular cells and branching macrophages are evidently a response to changes in the tissues of the gland caused by irradiation.

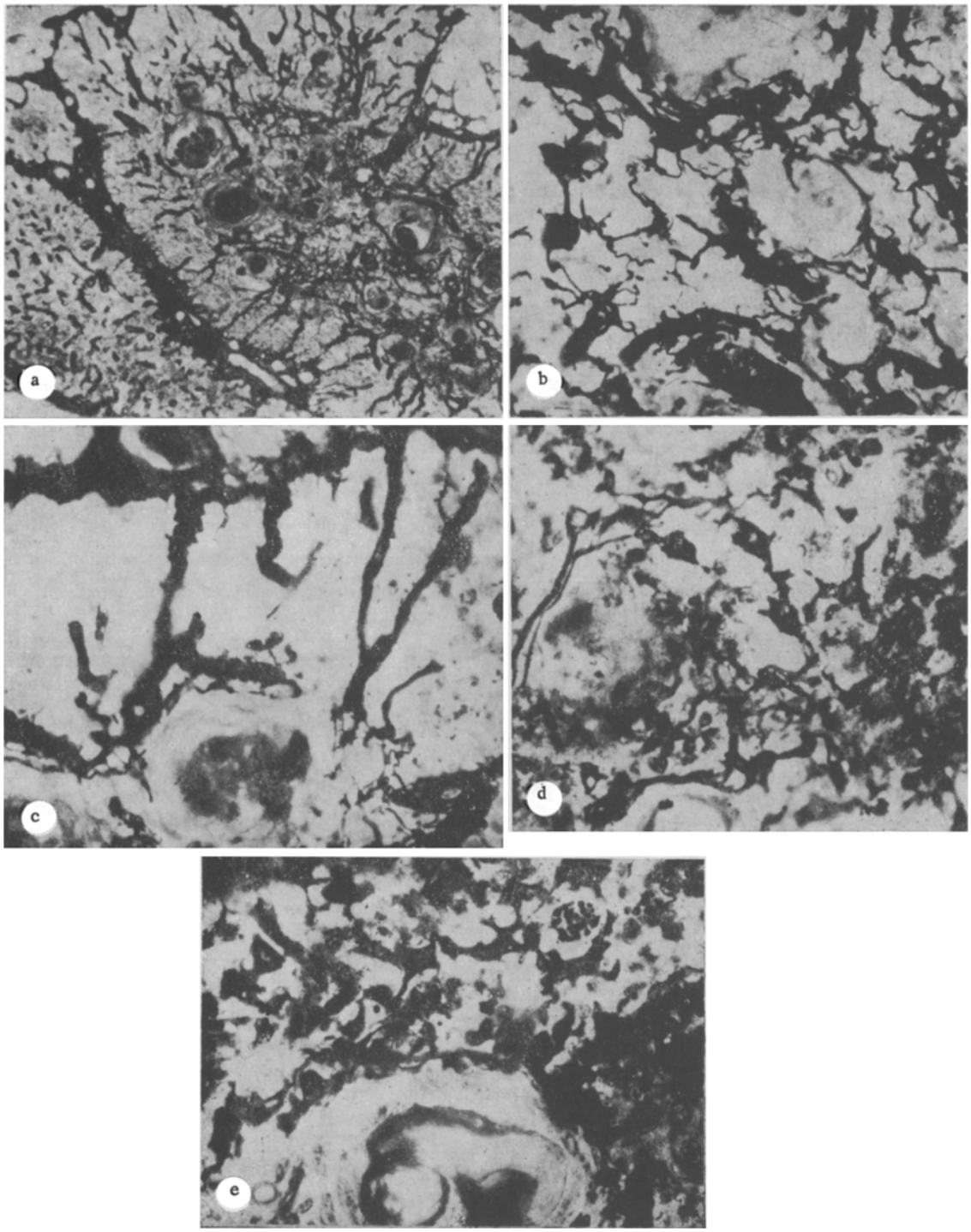

Fig. 1. Sections through thymus of guinea pig 48 h after x-ray irradiation: a) general view of lobule. Argyrophilic fibers visible in interlobular connective tissue, in walls of radially distributed blood vessels in cortex of lobule and in medulla as components of network of thin fibers; b) argyrophilic network in medullary zone of lobule. Reticulin fibers in direct contact with lamellar corpuscles, surrounding them practically on all sides; c) vessels of cortex, arranged radially, crossing into interlobular connective tissue. Fibers from the rigid argyrophilic framework of the vessel walls; d) histiocytes (branching macrophages) of medullary zone of lobule. Cytoplasm and processes of cells hypertrophied; e) histiocytes of medullary zone surround Hassall's corpuscles, but do not participate in their formation. Magnification: a) 80, b-e) 280×. a, b, c) Sections impregnated with silver by Gomori's method; d, e) by Beletskii's method.

Close structural connections were found between the reticular and epithelial tissues in both layers of the thymus lobules.

The discovery of all components of reticular tissue in the thymus confirms the correctness of the earlier hypothesis that reticular tissue, as the source of histogenesis of other forms of interstitial tissue, is present in all organs without exception [4].

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MORPHOLOGICAL ASPECTS OF AUTOGRAFTING OF A SYMPATHETIC GANGLION IN THE REGION OF HEMISECTION OF THE SPINAL CORD IN CATS

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KEY WORDS: regeneration; spinal cord; autografting; sympathetic ganglion.

Peripheral ganglia have been transplanted into brain tissue by Ranson [8, 9], Tidd [10], and Clark [7]. As the graft they used spinal ganglia which, after extirpation, were transplanted into the cortex of the experimental animals (rabbits or rats). The results of these experiments showed that the nerve cells of a ganglion could survive for up to 3 months, that the graft was slowly resorbed, and that it stimulated regeneration of the injured area of cortex. These workers did not undertake longer observations. In the accessible literature, no indication could be found to the use of ganglia of the sympathetic trunk in neuroplastic operations on the CNS.

Meanwhile, Soviet investigators [1-4] have shown that sympathetic ganglia can be effectively used to create new nerve centers and pathways of reinnervation for some internal organs. My own preliminary observations [5, 6] also demonstrate the high plasticity and powers of regeneration of nerve cells of the sympathetic ganglion after total transverse section of a preganglionic trunk or of the ganglion itself.

This paper gives the results of autografting of sympathetic ganglia on a nutrient pedicle, consisting of preserved interganglionic branches of the sympathetic trunk, into the region of hemisection of the spinal cord.

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