

EXPERIMENTAL UREMIA AS A MODEL PATHOLOGICAL CONDITION FOR THE STUDY OF THE MORPHOLOGY OF NERVE ENDINGS

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It is known that in pathological conditions nervous tissue greedily takes up silver. This property of nervous tissue has been used to study the histology of those nervous structures which are normally impregnated only with great difficulty. This is particularly true of the inter-neuronal synapses and receptors. Usually the material for study was taken from patients suffering from a fatal disease. Conditions such as cancer and tuberculosis greatly increase the affinity of all parts of the nervous system for silver salts, and at the same time cause considerable changes of the nervous elements. On this account it has been difficult to use the results to deduce the normal structure of these parts. It would be highly desirable to investigate not the terminal, but the intermediate or even the initial stages of the pathological process, though, of course, it could be obtained only from animal experiments.

We decided to select experimental uremia, because in previous investigations [3, 4] it was shown that nervous tissue is very sensitive to toxic products voided with the urine.

To induce uremia in cats a median incision was made in the abdominal wall immediately above the bladder and both ureters were ligated at their point of entry. After this operation the cats lived for 3-4 days. By the second day they had fallen into a comatose condition, which continued until death.

By this method we studied the condition of the pericellular apparatus in the ganglion of the lumbar, thoracic, and cervical parts of the sympathetic chains. The material was treated by the method of Bielschowsky-Gross and Deinek. In analyzing the results we referred to our own studies of synaptic structure in normal sympathetic feline ganglia [1].

Whereas normally the pericellular apparatus consists of fine rings of flask-shaped endings, in the current experiment these endings were found to be somewhat increased, thickened, and strongly argentophil. On account of the argentophilia the number of endings found was increased and showed certain details of structure not normally visible. The presynaptic threads were stained for a considerable length and their point of division into terminal branches could be seen. The neuropil at the synapse, which is normally visible only with great difficulty, could be made out more frequently and more clearly.

Changes in the nerve fibers and terminations were found in the impregnated preparations more frequently than were changes in the cell bodies. This made it possible, by varying the time for which the sections remained in the silver solution, to obtain preparations in which preganglionic fibers and preganglionic apparatuses appeared almost exclusively, whereas the bodies of the ganglion cells and their outgrowths could scarcely be seen. We got the impression that changes in the synapses in the ganglia of the lumbar region were better shown than they were in the thoracic ganglia, and much better shown than in the cervical ganglia.

As a result of experimental uremia the synapses may be completely destroyed, though the method proposed is of importance to us on account of the increased argentophilia of the nerve terminations, and we therefore recommend that the material should be taken not later than 36-40 h after ligation of both ureters.

Experimental uremia may be used for a study of the recovery processes in the nervous system. For this purpose it is advisable to apply a removable ligature on one ureter while ligating the second [4]. Removable ligatures have been described for blood vessels by G. A. Ionkin and A. N. Leonov [2].

By the method of experimental uremia combined with removable ligatures we were able to regulate the degree and the time of compression of the ureters and in this way to demonstrate the influence on the pathological process associated with toxemia.

The method we have proposed is simple and can be applied in any neurohistological laboratory.

SUMMARY

Experimental uremia has been proposed as a model pathological state for improving the impregnation of nerve endings. It was induced in cats by ligation of the ureters. Interneuronal connections in the lumbar, thoracic, and cervical portions of the sympathetic chains were studied. A comparison of the results with those obtained on normal animals showed that a considerably increased argentophilia had been induced, rendering the detailed structure more distinct.

LITERATURE CITED

1. V. P. Babmindra, Arkh. anat., 1958, No. 4, p. 85.
2. G. A. Ionkin and A. N. Leonov, Fiziol. zh. SSSR, No. 5, p. 425.
3. I. P. Korovin, The Pathological Anatomy of Uremia. Dissertation, St. Petersburg, 1897.
4. N. S. Kositsyn. In book: Author's abstracts of the 13th Scientific Student Conference of Volgograd Medical Institute, Volgograd, 1954, p. 8.

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