

ABSTRACT

STIMULATION OF REHABILITATION PROCESSES AFTER SPINAL CORD TRAUMA: T. N. NESMEYANOVA (1971). 'Nauka' Publishing House, Moscow.

The book is based on experimental data obtained on spinal animals and observation of patients suffering from spinal traumas.

At the outset, the concept is substantiated to the effect that the spinal cord after separation from the upper parts of the central nervous system acquires a high degree of plasticity. This is evidenced by the fact that it is possible by systematic stimulations of the skin to elaborate in the spinal animal new motor reflexes which persist for a long time and which it does not possess in its normal state. They may, however, be extinguished by weak, rare cutaneous stimuli. Elaborated reactions are always polysynaptic and have a greater number of relays than the basic reflex. The new plastic properties of the spinal cord may be used to rehabilitate the motor functions after its complete disruption.

A drastic decrease in afferent inflow and the absence of supraspinal influences bring about a rapid development of dystrophic processes in the distal section of the spinal cord. Most disturbed is the structure of interneurons and synapses on motoneurons. Accordingly, polysynaptic elaborated reactions are disturbed and, to a lesser degree, the inborn reflexes. Plastic properties of the spinal cord are not manifest.

To prevent the development of dystrophic processes, the spinal animals were subjected to additional afferent stimulations in the form of training. The latter consisted of massage, passive light exercises and electric skin stimulations, all of which were started on the first few days after the operation. The results have shown that such training actually wards off the development of dystrophic processes in the distal section of the spinal cord. The nerve cells remained within the norm. All reflexes were well pronounced, new reactions appeared and persisted. The possibility of a compensatory development of motor functions considerably increased due to training.

Regeneration of spinal paths may be another way of function rehabilitation.

The monograph analyses in detail the problem of peripheral and central pathways regeneration in mammals. The author proceeds from the following basic premises. The process of degeneration of the dissected nerve is preparatory to subsequent regeneration. The absence of intensive degeneration, namely of pronounced proteolytic enzyme activity in the central paths is mainly responsible for their weak growth. Another substantial impediment is the rapid scar formation at the site of the cord section.

Pyrogenal, a drug prepared at the Gamaley Institute of the U.S.S.R. Academy of Medical Sciences and tested by the author, proved to be an adequate inhibitor of the formation of coarse scars, retarding the maturation of fibroblasts and suppressing the proliferation of astrocytes. Activation of degeneration was induced by applying resorbing transplants introduced at the site of the cord section. Their stimulating action was manifested in a more complete regeneration of the pathways.

Proceeding from the idea that the growth of the nerve fibres, the proteosynthesis needs RNA, attempts were made to stimulate the RNA synthesis in the nerve cells. The results of administration of pyrimidine derivatives and of dinitryl malonic acid proved to be positive. When they were administered simultaneously with pyrogenal, regeneration was sufficiently well pronounced. The animals exhibited a rehabilitation of functions and morphological control disclosed bundles of nerve fibres growing across the area of the cord dissection.

Rehabilitation cure of patients with a trauma of the spine and the spinal cord, which is based on activation of reflex activity by means of selective intensive training, produced positive results. An essential improvement of the method consisted in administering pyrogenal to the patients, which, in addition to its effect on the scar tissue, activates the hypophysis-adrenal system.

The monograph outlines the results of treatment of twenty spinal patients of whom ten had a diagnosis of complete disruption of the cord. Data are presented on the electromyographic study of the activity of muscles of the lower limbs and the trunk in the patients during their attempts to move their legs, at different stages of the treatment.

It has been shown that at the beginning of the treatment the activity was recorded only in the muscles of the upper part of the body, but, as training continued, the lower regions of the body's long muscles were involved in the activity, then some muscles of the thighs and the buttocks and lastly, the muscles of the shins. The activity of the limb muscles somewhat differed from the normal. In the course of treatment the patients learned to walk with crutches and sticks by alternate movement of the legs, as well as to climb and descend stairways, and to make other movements.

The mechanism of involvement of limb muscles in activity appears to be as follows. The lower parts of the body's long muscles become active due to their innervation from both sections of the spinal cord. Involvement of the limb muscles takes place through activation of their muscle and skin receptors during passive movements of the legs or active movements of the trunk. Training helps to elaborate muscle response to a weak stimulation of the receptors proceeding from the patient's movement.

Thus, in the case where there is no conduction of excitation through the area of the spinal cord trauma, partial rehabilitation of the motor functions of the lower limbs may be effected in a compensatory way.

A decisive role in the development of compensatory processes is played by the capacity of the spinal cord functions for reorganisation due mainly to the possible propagation of excitation along new reflex arcs, to long preservation of its traces, and all this, provided the neuronal apparatus of the spinal cord is maintained in a normal state by means of training.

In cases of incomplete disruption of the spinal cord, the indicated treatment leads to restitution, the recovery of excitation conduction along the spinal cord and to complete rehabilitation of motor functions.

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