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Morphological changes in brain and spinal cord tissues following low intensity laser irradiation

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The influence of laser emission on opened intact brain and spinal cord was studied in two series of 92 animals.

Semiconductor laser (L = 830 nm) was used in series I, and He-Ne laser (L=630) in series II. Output power of each laser was 4 mVt. Exposure time was 3.5, 15 and 30 minutes in each series of experiment. Cerebral tissue was examined during acute period in 24 hours, 5 and 15 days after the radiation by means of conventional histological viewing technique.

The most pronounced morphological changes in the brain and spinal cord were revealed in 24 hours after radiation by semiconductor laser with the exposure time being 30 minutes. The most severe damages take place in subcortical layer of the brain and in pyramidal cells of posterior horns of the spinal cord. These changes may be classified as pyknosis and Kariorrhexis of glial cells. The manifestation of edema to the extent of edema to the extent of kribrosis changes in the white matter catches the eye. The cerebral cortex suffers the least.

At 5 days examination the changes in pyramidal cells of the spinal cord and glial cells of the brain appear less severe. The edema of cerebral tissue is still noticeable.

At 15 days examination the structure of nerve cells is changed not significantly. The edema of the white matter is less pronounced.

The examination of cerebral specimens in acute period and in 24 hours after He-Ne laser radiation reveals significantly less morphological changes as compared with previous series. Minimal damage of the cortex and the white matter of the brain and posterior horn neurons of the spinal cord manifest themselves in irregular granulation of cortex neurons with minimal tigrolysis in isolated cells. The edema of the white matter of the brain and the dorsal columns of the spinal cord is uncomparably less manifested.

At 5 days cortex cells of the brain and pyramidal cells of posterior columns of the spinal cord appear intact. Signs of pericellular edema are practically absent.

At 15 days the histological picture is normalized.

Thus, the experimental comparison studies of two types of lasers have revealed the principal difference of their influence in the structure of nerve cells. Subcortical layer of brain gliial tissue and pyramidal cells of the posterior spinal columns are the most damageable by the semiconductor laser emission. Yet these changes regress rapidly and at 15 days only the signs of regressing edema of the cerebral matters, and very light dystrophic changes in neurons in regressive phase are preserved.

The most intact structure of cellular and extracellular elements of white and grey matter is preserved in case of the exposure to He-Ne laser. The changes are practically not detectable at 5 days of the experiment and at 15 days the cerebral tissue appears intact.