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Phototherapy of intraventricular hemorrhages in mice

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Intraventricular hemorrhage (IVH) is one of the most dangerous forms of brain injury. Blood is toxic and therefore, the faster it is removed, the higher the chances of restoring normal brain functions. However, there are no current non-invasive methods to effectively remove blood from the brain. Therefore, the processes of blood excretion in mice with cerebral hemorrhages were studied using photostimulation in vivo and in vitro. Photobiomodulation (PBM) is the use of visible and near-infrared radiation to stimulate cellular processes of biochemical activity of mitochondrial components at non-thermal and low-level doses. Currently, PBM has gained significant credibility and is becoming one of the most common physical treatment methods. PBM may serve as a non-invasive neuroprotective strategy for the effective removal of toxins, including blood, since PBM has been shown to have stimulating effects on meningeal lymphatic vessels (MLVs), which play a key role in the clearance of metabolites through both the cerebrospinal fluid and interstitial fluid from the central nervous system into cervical lymph nodes.

This study examined the effects of PBM on the processes of lymphatic clearance of red blood cells from the brain tissue of mice with IVH. It was found that PBM significantly increases the number of red blood cells removed from the ventricular system into the peripheral lymphatic system. This is accompanied by faster recovery processes from the development of perivascular edema, which also helps to effectively reduce intracranial pressure and reduce the volume of the hematoma. A course of PBM for 10 days significantly improves the recovery of neurological parameters in mice compared to individuals not receiving phototherapy. These results indicate that PBM is a promising method for the treatment of IVH by stimulating the lymphatic processes of removing blood products from the brain that are toxic to its tissues.

Key words: intraventricular hemorrhages, photobiomodulation.

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