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Hyperbaric Oxygen Therapy after Mid-Cervical Spinal Contusion Injury

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Abstract

Hyperbaric oxygen (HBO) therapy is frequently used to treat peripheral wounds or decompression sickness. Evidence suggests that HBO therapy can provide neuroprotection and has an anti-inflammatory impact after neurological injury, including spinal cord injury (SCI). Our primary purpose was to conduct a genome-wide screening of mRNA expression changes in the injured spinal cord after HBO therapy. An mRNA gene array was used to evaluate samples taken from the contused region of the spinal cord following a lateralized mid-cervical contusion injury in adult female rats. HBO therapy consisted of daily, 1-h sessions (3.0 ATA, 100% O_2) initiated on the day of SCI and continued for 10 days. Gene set enrichment analyses indicated that HBO upregulated genes in pathways associated with electron transport, mitochondrial function, and oxidative phosphorylation, and downregulated genes in pathways associated with inflammation (including cytokines and nuclear factor kappa B [NF-κB]) and apoptotic signaling. In a separate cohort, spinal cord histology was performed to verify whether the HBO treatment impacted neuronal cell counts or inflammatory markers. Compared with untreated rats, there were increased NeuN positive cells in the spinal cord of HBO-treated rats (p = 0.004). We conclude that HBO therapy, initiated shortly after SCI and continued for 10 days, can alter the molecular signature of the lesioned spinal cord in a manner consistent with a neuroprotective impact.