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Hydrogen gas alleviates oxygen toxicity by reducing hydroxyl radical levels in PC12 cells

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Abstract

Hyperbaric oxygen (HBO) therapy through breathing oxygen at the pressure of above 1 atmosphere absolute (ATA) is useful for varieties of clinical conditions, especially hypoxic-ischemic diseases. Because of generation of reactive oxygen species (ROS), breathing oxygen gas at high pressures can cause oxygen toxicity in the central nervous system, leading to multiple neurological dysfunction, which limits the use of HBO therapy. Studies have shown that Hydrogen gas (H2) can diminish oxidative stress and effectively reduce active ROS associated with diseases. However, the effect of H2 on ROS generated from HBO therapy remains unclear. In this study, we investigated the effect of H2 on ROS during HBO therapy using PC12 cells. PC12 cells cultured in medium were exposed to oxygen gas or mixed oxygen gas and H2 at 1 ATA or 5 ATA. Cells viability and oxidation products and ROS were determined. The data showed that H2 promoted the cell viability and inhibited the damage in the cell and mitochondria membrane, reduced the levels of lipid peroxidation and DNA oxidation, and selectively decreased the levels of •OH but not disturbing the levels of O2•−, H2O2, or NO• in PC12 cells during HBO therapy. These results indicated that H2 effectively reduced •OH, protected cells against oxygen toxicity resulting from HBO therapy, and had no effect on other ROS. Our data supported that H2 could be potentially used as an antioxidant during HBO therapy.

Figures

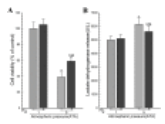

Fig 1. Hydrogen gas promoted the viability...

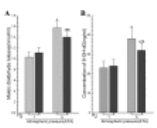

Fig 2. Hydrogen gas reduced the levels...

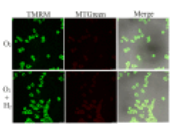

Fig 3. Hydrogen gas inhibited decrease in...

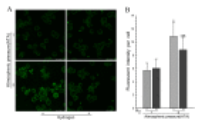

Fig 4. Hydrogen gas decreased the •OH...

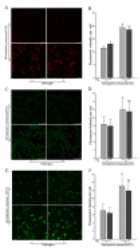

Fig 5. Hydrogen gas had no effect...

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