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# Hydrogen Gas Inhalation Treatment in Acute Cerebral Infarction: A Randomized Controlled Clinical Study on Safety and Neuroprotection

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## Abstract

**Background:** Molecular hydrogen (H<sub>2</sub>) acts as a therapeutic antioxidant. Inhalation of H<sub>2</sub> gas (1-4%) was effective for the improvement of cerebral infarction in multiple animal experiments. Thus, for actual applications, a randomized controlled clinical study is desired to evaluate the effects of inhalation of H<sub>2</sub> gas. Here, we evaluate the H<sub>2</sub> treatment on acute cerebral infarction.

**Methods:** Through this randomized controlled clinical study, we assessed the safety and effectiveness of H<sub>2</sub> treatment in patients with cerebral infarction in an acute stage with mild- to moderate-severity National Institute of Health Stroke Scale (NIHSS) scores (NIHSS = 2-6). We enrolled 50 patients (25 each in the H<sub>2</sub> group and the control group) with a therapeutic time window of 6 to 24 hours. The H<sub>2</sub> group inhaled 3% H<sub>2</sub> gas (1 hour twice a day), and the control group received conventional intravenous medications for the initial 7 days. The evaluations included daily vital signs, NIHSS scores, physical therapy indices, weekly blood chemistry, and brain magnetic resonance imaging (MRI) scans over the 2-week study period.

**Results:** The H<sub>2</sub> group showed no significant adverse effects with improvements in oxygen saturation. The following significant effects were found: the relative signal intensity of MRI, which indicated the severity of the infarction site, NIHSS scores for clinically quantifying stroke severity, and physical therapy evaluation, as judged by the Barthel Index.

**Conclusions:** H<sub>2</sub> treatment was safe and effective in patients with acute cerebral infarction. These results suggested a potential for widespread and general application of H<sub>2</sub> gas.

**Keywords:** Barthel Index; Hydrogen gas; MRI; National Institute of Health Stroke Scale; acute cerebral infarction; neuroprotection; randomized controlled clinical study.

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