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Hydrogen-rich saline reduces delayed neurologic sequelae in experimental carbon monoxide toxicity

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Abstract

Objective: We investigated the feasibility and efficacy of hydrogen-rich saline therapy on delayed neurologic sequelae in a rat model of severe acute carbon monoxide (CO) poisoning.

Design: Controlled animal study.

Setting: University research laboratory for Diving Medicine.

Subjects: Sprague-Dawley rats weighing 250 ± 20 g.

Interventions: The rats were exposed to 1000 ppm CO in air for 40 min and then to 3000 ppm for another 20 min until they lost consciousness. Rats were intraperitoneal injected with hydrogen-rich saline or normal saline (10 mL/kg) for six times after resuscitation at 0, 12, 24, 36, 48, and 60 hrs, respectively. The rats without CO poisoning were used as normal controls.

Measurements and main results: Brain tissue inflammation, cell death, and cognitive dysfunction were observed at one week after CO poisoning. Hydrogen-rich saline treatment significantly reduced the level of degraded myelin basic protein, decreased the expression of ionized calcium-binding adapter molecule 1, Iba1, a microglial marker, reduced DNA oxidation, and suppressed proinflammatory cytokine interleukin-1β, interleukin-6, and tumor necrosis factor-α in the cortex and hippocampal tissues when compared with those in normal saline-treated rats. These histologic and biological improvements were accompanied with an improvement in the Morris water maze test.

Conclusions: This observation demonstrated that hydrogen-rich saline peritoneal injection improves histologic and functional assessment in a rat model of CO encephalopathy. Hydrogen saline has potentials as a novel and alternative therapy for severely CO-poisoned patients with delayed neurologic sequelae. The therapeutic effects of hydrogen-rich saline may be related to antioxidant and anti-inflammatory actions.

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