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Combination of Hydrogen Inhalation and Hypothermic Temperature Control After Out-of-Hospital Cardiac Arrest: A Post hoc Analysis of the Efficacy of Inhaled Hydrogen on Neurologic Outcome Following Brain Ischemia During PostCardiac Arrest Care II Trial

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Efficacy of Inhaled Hydrogen on Neurologic Outcome Following Brain Ischemia During PostCardiac Arrest Care (HYBRID II) Study Group

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Abstract

Objective: The Efficacy of Inhaled Hydrogen on Neurologic Outcome Following Brain Ischemia During Post-Cardiac Arrest Care (HYBRID) II trial (jRCTs031180352) suggested that hydrogen inhalation may reduce post-cardiac arrest brain injury (PCABI). However, the combination of hypothermic target temperature management (TTM) and hydrogen inhalation on outcomes is unclear. The aim of this study was to investigate the combined effect of hydrogen inhalation and hypothermic TTM on outcomes after out-of-hospital cardiac arrest (OHCA).

Design: Post hoc analysis of a multicenter, randomized, controlled trial.

Setting: Fifteen Japanese ICUs.

Patients: Cardiogenic OHCA enrolled in the HYBRID II trial.

Interventions: Hydrogen mixed oxygen (hydrogen group) versus oxygen alone (control group).

Measurements and main results: TTM was performed at a target temperature of 32-34°C (TTM32-TTM34) or 35-36°C (TTM35-TTM36) per the institutional protocol. The association between hydrogen + TTM32-TTM34 and 90-day good neurologic outcomes was analyzed using generalized estimating equations. The 90-day survival was compared between the hydrogen and control groups under TTM32-TTM34 and TTM35-TTM36, respectively. The analysis included 72 patients (hydrogen [n = 39] and control [n = 33] groups) with outcome data. TTM32-TTM34 was implemented in 25 (64%) and 24 (73%) patients in the hydrogen and control groups, respectively (p = 0.46). Under TTM32-TTM34, 17 (68%) and 9 (38%) patients achieved good neurologic outcomes in the hydrogen and control groups, respectively (relative risk: 1.81 [95% CI, 1.05-3.66], p < 0.05). Hydrogen + TTM32-TTM34 was independently associated with good neurologic outcomes (adjusted odds ratio 16.10 [95% CI, 1.88-138.17], p = 0.01). However, hydrogen + TTM32-TTM34 did not improve survival compared with TTM32-TTM34 alone (adjusted hazard ratio: 0.22 [95% CI, 0.05-1.06], p = 0.06).

Conclusions: Hydrogen + TTM32-TTM34 was associated with improved neurologic outcomes after cardiogenic OHCA compared with TTM32-TTM34 monotherapy. Hydrogen inhalation is a promising treatment option for reducing PCABI when combined with TTM32-TTM34.

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Figures

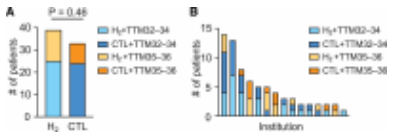

Figure 1. Selection of a target temperature....

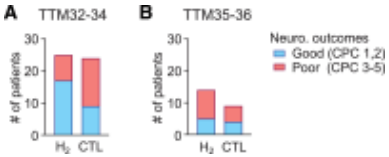

Figure 2. Combination therapy of hydrogen gas...

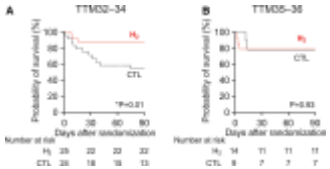

Figure 3. Combination therapy of H 2...

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