Prevention of ischemia-induced hearing loss by intravenous administration of hydrogen-rich saline in gerbil.

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Abstract

OBJECTIVE: Hydrogen-rich water, which is a potent antioxidant agent, was investigated for its protective effects against ischemic damage of the cochlea in gerbils.

METHODS: The animals were subjected to transient cochlear ischemia by occluding the bilateral vertebral arteries for 15 min. Five milliliters of hydrogen-rich saline was then intravenously administered immediately after the insult. Saline without hydrogen was used as a control. Effects of hydrogen were evaluated using the auditory brainstem response (ABR) and histological studies of the inner ear.

RESULTS: In non-ischemia animals, ABR thresholds and histological findings of the cochlea did not change by administration of saline or hydrogen-rich saline. In contrast, transient cochlear ischemia caused a 24.2±3.8 dB increase in the ABR threshold at 8 kHz, and a decrease of 14.1%±1.8% in the number of inner hair cells (IHCs) at the basal turn on day 7. Ischemic damage was more severe at 16 and 32 kHz. When the animals were treated with hydrogen-rich saline, cochlear damage was significantly reduced: the increase in ABR threshold was 11.7±2.6 dB at 8 kHz and the IHC loss was 7.5%±2.1% at the basal turn on day 7. The effects of hydrogen-rich saline were more prominent at higher frequencies.

CONCLUSIONS: Intravenous administration of hydrogen-rich saline was effective in preventing acute hearing loss due to transient cochlear ischemia.

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KEYWORDS: Anti-oxidative effect; Hydrogen-rich water; Mongolian gerbil; Prevention of hearing loss; Transient cochlear ischemia

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