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Hydrogen alleviates cellular senescence via regulation of ROS/p53/p21 pathway in bone marrow-derived mesenchymal stem cells in vivo

Wenbo Zhang [1], Chao Huang [2], Aijun Sun [2], Liang Qiao [2], Xi Zhang [2], Junlong Huang [3], Xuejun Sun [3], Xiangqun Yang [4], Shanquan Sun [5]

Affiliations

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Abstract

Senescence has become a hot point issue in recent decades and requires urgent attention. As a novel and effective antioxidant, hydrogen has been proved to alleviate cellular senescence in endothelial cells in vitro. However, the effects and mechanisms of hydrogen on senescence in vivo are still unclear. In the present study, 12-month-old Sprague Dawley (SD) rats were intraperitoneal administration of hydrogen-rich saline (HRS, 10 ml/kg). Subsequently, bone marrow-derived stem cells (BMSCs) were harvested for the detection of hydrogen antisenescence effects and mechanisms. The results showed that the number of senescence-associated β-galactosidase (SA-β-Gal) positive cells was reduced in BMSCs from rats treated with HRS. BMSCs in rats treated with HRS possessed a better proliferation ability, showed more effectively tri-lineage differentiation potential, and had less percentage of cells in G1 cell cycle arrest than the control cells. Additionally, HRS administration inhibited the production of intracellular reactive oxygen species (ROS) and decreased the expression of senescence-related proteins p53 and p21. Our results revealed that hydrogen could alleviate cellular senescence in vivo. And the underlying mechanism of antisenescence effects of hydrogen in BMSCs was via the ROS/p53/p21 signaling pathway. Thus, hydrogen could be a new and convenient strategy for alleviating senescence and for therapy of age-related diseases.

Keywords: Antisenescence; Bone marrow-derived mesenchymal stem cells; Hydrogen; ROS/p53/p21.

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