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Constitutive hydrogen inhalation prevents vascular remodeling via reduction of oxidative stress

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Abstract

Molecular hydrogen is thought to have an inhibitory effect on oxidative stress, thereby attenuating the onset and progression of various diseases including cardiovascular disease; however, few reports have assessed the preventive effect of constitutive inhalation of hydrogen gas on of vascular remodeling. Here, we investigated the effect of constitutive inhalation of hydrogen gas on vascular neointima formation using a cuff-induced vascular injury mouse model. After constitutive inhalation of compressed hydrogen gas (O2 21%, N2 77.7%, hydrogen 1.3%) or compressed air only (O2 21%, N2 79%) by C57BL/6 mice for 2 weeks from 8 weeks of age in a closed chamber, inflammatory cuff

injury was induced by polyethylene cuff placement around the femoral artery under anesthesia, and hydrogen gas administration was continued until sampling of the femoral artery. Neointima formation, accompanied by an increase in cell proliferation, was significantly attenuated in the hydrogen group compared with the control group. NADPH oxidase NOX1 downregulation in response to cuff injury was shown in the hydrogen group, but the expression levels of NADPH oxidase subunits, p40phox and p47phox, did not differ significantly between the hydrogen and control groups. Although the increase in superoxide anion production did not significantly differ between the hydrogen and control groups, DNA damage was decreased as a result of reduction of reactive oxygen species such as hydroxyl radical (·OH) and peroxynitrite (ONOO-) in the hydrogen group. These results demonstrate that constitutive inhalation of hydrogen gas attenuates vascular remodeling partly via reduction of oxidative stress, suggesting that constitutive inhalation of hydrogen gas at a safe concentration in the living environment could be an effective strategy for prevention of vascular diseases such as atherosclerosis.

Figures

Fig 1. A Closed chamber used in...

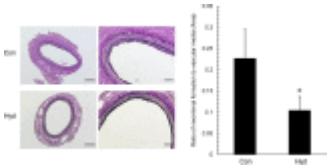

Fig 2. Effect of hydrogen gas inhalation...

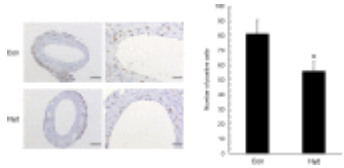

Fig 3. Effect of hydrogen gas inhalation...

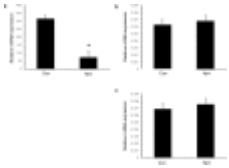

Fig 4. Effect of hydrogen gas inhalation...

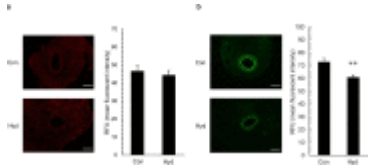

Fig 5. Effect of hydrogen gas inhalation...

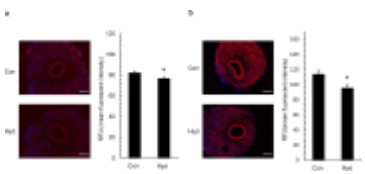

Fig 6. Effect of hydrogen gas on...

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