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Attenuation of cigarette smoke-induced airway mucus production by hydrogen-rich saline in rats

Yunye Ning [1], Yan Shang [1], Haidong Huang [1], Jingxi Zhang [1], Yuchao Dong [1], Wujian Xu [1], Qiang Li [1]

Affiliations

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Abstract

Background: Over-production of mucus is an important pathophysiological feature in chronic airway disease such as chronic obstructive pulmonary disease (COPD) and asthma. Cigarette smoking (CS) is the leading cause of COPD. Oxidative stress plays a key role in CS-induced airway abnormal mucus production. Hydrogen protected cells and tissues against oxidative damage by scavenging hydroxyl radicals. In the present study we investigated the effect of hydrogen on CS-induced mucus production in rats.

Methods: Male Sprague-Dawley rats were divided into four groups: sham control, CS group, hydrogen-rich saline pretreatment group and hydrogen-rich saline control group. Lung morphology and tissue biochemical changes were determined by immunohistochemistry, Alcian Blue/periodic acid-Schiff staining, TUNEL, western blot and realtime RT-PCR.

Results: Hydrogen-rich saline pretreatment attenuated CS-induced mucus accumulation in the bronchiolar lumen, goblet cell hyperplasia, muc5ac over-expression and abnormal cell apoptosis in the airway epithelium as well as malondialdehyde increase in the BALF. The phosphorylation of EGFR at Tyr1068 and Nrf2 up-regulation expression in the rat lungs challenged by CS exposure were also abrogated by hydrogen-rich saline.

Conclusion: Hydrogen-rich saline pretreatment ameliorated CS-induced airway mucus production and airway epithelium damage in rats. The protective role of hydrogen on CS-exposed rat lungs was achieved at least partly by its free radical scavenging ability. This is the first report to demonstrate that intraperitoneal administration of hydrogen-rich saline protected rat airways against CS damage and it could be promising in treating abnormal airway mucus production in COPD.

Figures

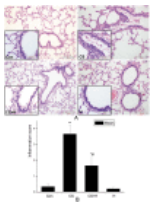

Figure 1. Effect of hydrogen on lung...

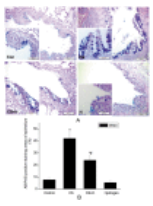

Figure 2. Effect of hydrogen on goblet...

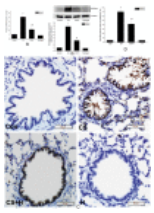

Figure 3. Effect of hydrogen on CS-induced...

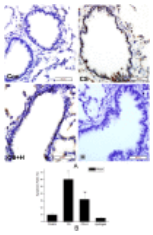

Figure 4. Effect of hydrogen on CS-induced...

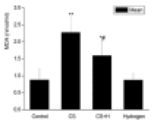

Figure 5. Effect of hydrogen on CS-induced...

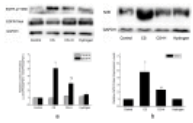

Figure 6. Effect of hydrogen on CS-induced...

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