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Inhalation of Hydrogen Attenuates Progression of Chronic Heart Failure via Suppression of Oxidative Stress and P53 Related to Apoptosis Pathway in Rats

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Abstract

Background: Continuous damage from oxidative stress and apoptosis are the important mechanisms that facilitate chronic heart failure (CHF). Molecular hydrogen (H_2) has potentiality in the aspects of anti-oxidation. The objectives of this study were to investigate the possible mechanism of H_2 inhalation in delaying the progress of CHF. **Methods and Results:** A total of 60 Sprague-Dawley (SD) rats were randomly divided into four groups: Sham, Sham treated with H_2, CHF and CHF treated with H_2. Rats from CHF and CHF treated with H_2 groups were injected isoprenaline subcutaneously to establish the rat CHF model. One month later, the rat with CHF was identified by the echocardiography. After inhalation of H_2, cardiac function was improved vs. CHF ($p < 0.05$), whereas oxidative stress damage and apoptosis were significantly attenuated ($p < 0.05$). In this study, the mild oxidative stress was induced in primary cardiomyocytes of rats, and H_2 treatments significantly reduced oxidative stress damage and apoptosis in cardiomyocytes ($p < 0.05$ or $p < 0.01$). Finally, as a pivotal transcription factor in reactive oxygen species (ROS)-apoptosis signaling pathway, the expression and phosphorylation of p53 were significantly reduced by H_2 treatment in this rat model and H9c2 cells ($p < 0.05$ or $p < 0.01$). **Conclusion:** As a safe antioxidant, molecular hydrogen mitigates the progression of CHF via inhibiting apoptosis modulated by p53. Therefore, from the translational point of view and speculation, H_2 is equipped with potential therapeutic application as a novel antioxidant in protecting CHF in the future.

Keywords: apoptosis; chronic heart failure; hydrogen; oxidative stress; p53.

Figures

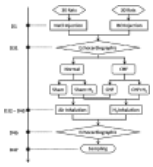

FIGURE 1 The time course of the...

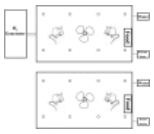

FIGURE 2 The H_2 and air...

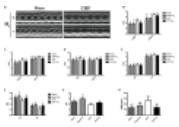

FIGURE 3 Cardiac structure and function. **(A)...**

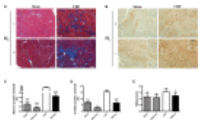

FIGURE 4 Left ventricular remodeling size and...

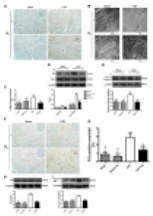

FIGURE 5 Effects of H_2 on...

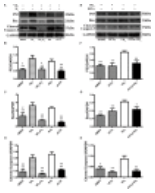

FIGURE 6 Analysis for effects of H...

All figures (9)

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