Mol Med Rep. 2017 Aug;16(2):1771-1778. doi: 10.3892/mmr.2017.6849. Epub 2017 Jun 23.

Hydrogen-containing saline alleviates pressure overload-induced interstitial fibrosis and cardiac dysfunction in rats

Jing Yang [1], Shujing Wu [1], Liqun Zhu [2], Jingjing Cai [1], Lu Fu [1]

Affiliations

PMID: 28656216 PMCID: PMC5562058 DOI: 10.3892/mmr.2017.6849

Free PMC article

Abstract

Cardiac fibrosis induced by sustained pressure overload contributes to heart failure. Oxidative stress serves an important role in cardiac remodeling and heart failure independent of etiological factors. The application of hydrogen as an antioxidant is a novel concept in disease treatment, however no studies as present have investigated the effects of hydrogen on cardiac fibrosis. In the present study, the effects of hydrogen on pressure overload-induced cardiac fibrosis and heart failure were investigated in abdominal aortic-constricted rats. Masson's trichrome staining and echocardiography were used to evaluate the fibrotic area and cardiac function, respectively. Reactive oxygen species (ROS) content was detected by immunofluorescence. Malondialdehyde (MDA) concentration, the activity of superoxide dismutase (SOD) and hydroxyproline content were measured by spectrophotometry. Western blot analysis was used to detect the protein levels of transforming growth factor (TGF)-β1, connective tissue growth factor (CTGF), NADPH oxidases (NOX)2, NOX4, p38 mitogen-activated protein kinase (MAPK) and Smad2/3. Reverse transcription-quantitative polymerase chain reaction was performed to detect the mRNA expression of collagen I (Col I) and fibronectin 1 (FN1). Hydrogen-containing saline (HCS) treatment was observed to improve interstitial fibrosis and cardiac function and to decrease the level of ROS, the oxidative-stress marker MDA and expression of NOXs, while increasing the activity of the anti-oxidant enzyme SOD. HCS treatment also decreased the phosphorylation of p38 MAPK and Smad2/3, and the expression of TGF-β1 and CTGF, which were accompanied by reduced hydroxyproline content, Col I and FN1 mRNA levels. These results indicate that HCS treatment can improve cardiac function by reducing interstitial fibrosis in pressure-overloaded rats through its anti-oxidative properties and via suppression of TGF-β1 signaling.

Figures

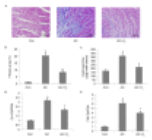

Figure 1. Effect of H_2 on...

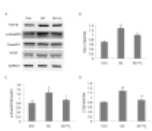

Figure 2. Effect of H_2 on...

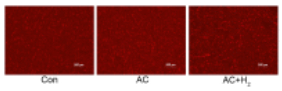

Figure 3. Effect of H_2 on...

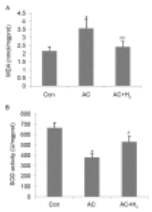

Figure 4. Myocardium MDA levels (A) and...

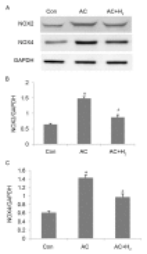

Figure 5. Effect of H_2 on...

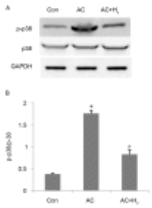

Figure 6. Effect of H_2 on...

All figures (7)

Related information

MedGen
PubChem Compound (MeSH Keyword)

LinkOut - more resources

Full Text Sources
Europe PubMed Central
Ingenta plc
Ovid Technologies, Inc.
PubMed Central
Spandidos Publications

Other Literature Sources
scite Smart Citations

Research Materials
GeneTex Inc

Miscellaneous
NCI CPTAC Assay Portal