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Hydrogen-Rich Saline Ameliorates Allergic Rhinitis by Reversing the Imbalance of Th1/Th2 and Up-Regulation of CD4+CD25+Foxp3+Regulatory T Cells, Interleukin-10, and Membrane-Bound Transforming Growth Factor- β in Guinea Pigs

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Abstract

It is well known that CD4+CD25+Foxp3+Treg cells play an important role in the development of allergic rhinitis (AR); the defect of cell numbers and functions contribute to AR. Hydrogen has been proven effective in alleviating symptoms of AR. We herein aim to verify the protective effects of hydrogen on CD4+CD25+Foxp3+Treg cells in guinea pigs with AR and to explore the effect of hydrogen-rich saline (HRS) on CD4+CD25+Foxp3+Treg cells in animals with AR and investigate the underlying anti-inflammatory mechanism. Eighteen guinea pigs were randomly divided into three groups (control group/AR group/AR-HRS group). The guinea pigs were injected with hydrogen-rich saline (AR-HRS group) for 10 days after sensitization. The control group was injected with an equal volume of normal saline. The number of sneezes, degree of runny nose, and nasal-rubbing movements were scored. Peripheral blood eosinophil count was recorded. The proportions of Th1/Th2 of the peripheral blood and the CD4+CD25+Foxp3+T cells in the CD4+T cells of the spleen and peripheral blood were determined by flow cytometry. The content of interleukin (IL)-10 and transforming growth factor (TGF)- β in the serum was detected by enzyme-linked immunosorbent assay (ELISA). The protein and mRNA expression of Foxp3, IL-10, and TGF- β were determined by Western blot, immunofluorescence, and real-time PCR analysis, respectively. Scores of symptoms, number of eosinophils, and nasal mucosa damage were dramatically reduced after HRS treatment. HRS increased the expression of Foxp3, IL-10, TGF- β , and number of CD4+CD25+Foxp3+Treg cells, which were reduced in AR. HRS also revised the dysregulation of Th1/Th2 balance. Both the number and biological activity of CD4+CD25+Foxp3+Treg cells increased with up-regulation of Th1/Th2 after HRS administration. HRS could play a protective role in attenuating AR through improving the proportion and functions of CD4+CD25+Foxp3+Treg cells.

Keywords: T-lymphocytes; allergic rhinitis; guinea pig; hydrogen-rich saline; regulatory T cell.

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