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Molecular hydrogen suppresses reactive astrogliosis related to oxidative injury during spinal cord injury in rats

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Abstract

Aims: Spinal cord injury (SCI) can induce excessive astrocyte activation. Hydrogen has been deemed as a novel antioxidant. We investigated whether molecular hydrogen could act as an antiastrogliosis agent during SCI and oxidative injury in experimental rats and cultured astrocytes.

Methods: Hydrogen-rich saline (HS, 8 mL/kg, i.p.) was injected every 12 h after SCI in rats. The expression of STAT3, p-STAT3, and glial fibrillary acidic protein (GFAP); the release of IL-1β, IL-6, and TNF-α; and astrogliosis, along with the BBB score, were evaluated. Culturing astrocytes with hydrogen-rich medium, the intracellular reactive oxygen species (ROS), astrogliosis, and the release of proinflammatory cytokines were assessed after H2O2-induced injury.

Results: In the HS group, the expression of STAT3, p-STAT3, and GFAP and the proinflammatory cytokines were decreased in local spinal cord on postoperation day (POD) 3; on PODs 7 and 14, reactive astrogliosis was suppressed, and the locomotor function was also improved. Furthermore, hydrogen-rich medium attenuated the intracellular production of ROS (especially HO•), astrogliosis, and the secretion of proinflammatory cytokines in astrocytes 12 h after H2O2-induced injury.

Conclusions: Molecular hydrogen could suppress reactive astrogliosis after contusive SCI and reduce the release of proinflammatory cytokines produced by active astrocytes related to oxidative injury. Thus, molecular hydrogen is potential to be a neuroprotective agent.

Keywords: Astrogliosis; Glial scar; Hydrogen; Oxidative injury; Spinal cord injury.

Figures

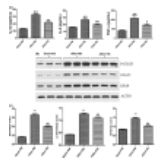

Figure 1 On postoperation day (POD...

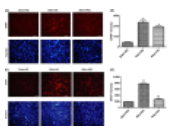

Figure 2 (**A, B**) Immunohistochemistry...

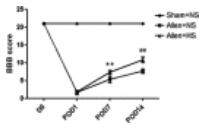

Figure 3 Locomotor function was evaluated before...

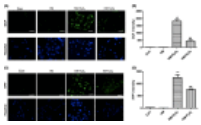

Figure 4 Twelve hours after adding H...

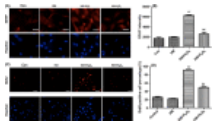

Figure 5 Twelve hours after adding H...

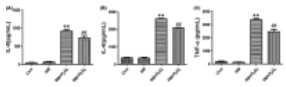

Figure 6 Twelve hours after adding H...

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