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Molecular hydrogen attenuates neuropathic pain in mice

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Abstract

Neuropathic pain remains intractable and the development of new therapeutic strategies are urgently required. Accumulating evidence indicates that overproduction of oxidative stress is a key event in the pathogenesis of neuropathic pain. However, repeated intra-peritoneal or intrathecal injections of antioxidants are unsuitable for continuous use in therapy. Here we show a novel therapeutic method against neuropathic pain: drinking water containing molecular hydrogen (H2) as antioxidant. The effect of hydrogen on neuropathic pain was investigated using a partial sciatic nerve ligation model in mice. As indicators of neuropathic pain, temporal aspects of mechanical allodynia and thermal hyperalgesia were analysed for 3 weeks after ligation. Mechanical allodynia and thermal hyperalgesia were measured using the von Frey test and the plantar test, respectively. When mice were allowed to drink water containing hydrogen at a saturated level ad libitum after ligation, both allodynia and hyperalgesia were alleviated. These symptoms were also alleviated when hydrogen was administered only for the induction phase (from day 0 to 4 after ligation). When hydrogen was administered only for the maintenance phase (from day 4 to 21 after ligation), hyperalgesia but not allodynia was alleviated. Immunohistochemical staining for the oxidative stress marker, 4-hydroxy-2-nonenal and 8-hydroxydeoxyguanosine, showed that hydrogen administration suppressed oxidative stress induced by ligation in the spinal cord and the dorsal root ganglion. In conclusion, oral administration of hydrogen water may be useful for alleviating neuropathic pain in a clinical setting.

Figures

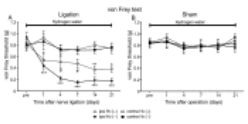

Figure 1. Hydrogen treatment suppressed mechanical allodynia...

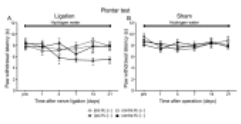

Figure 2. Hydrogen treatment suppressed thermal hyperalgesia...

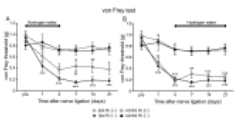

Figure 3. Hydrogen treatment was effective against...

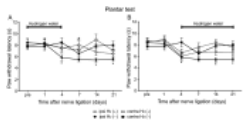

Figure 4. Hydrogen treatment was effective against...

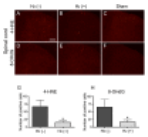

Figure 5. Hydrogen suppressed the development of...

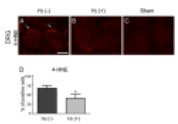

Figure 6. Hydrogen suppressed the development of...

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