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[Transpl Int](#). 2012 Dec;25(12):1213-22. doi: 10.1111/j.1432-2277.2012.01542.x. Epub 2012 Aug 14.

Hydrogen-supplemented drinking water protects cardiac allografts from inflammation-associated deterioration

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PMID: 22891787 DOI: [10.1111/j.1432-2277.2012.01542.x](#)

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Abstract

Recent evidence suggests that molecular hydrogen has therapeutic value for disease states that involve inflammation. We hypothesized that drinking hydrogen-rich water (HW) daily would protect cardiac and aortic allograft recipients from inflammation-associated deterioration. Heterotopic heart transplantation with short-course tacrolimus immunosuppression and orthotopic aortic transplantation were performed in allogeneic rat strains. HW was generated either by bubbling hydrogen gas through tap water (Bu-HW) or via chemical reaction using a magnesium stick [$\text{Mg} + 2\text{H}(2)\text{O} \rightarrow \text{Mg}(\text{OH})(2) + \text{H}(2)$] immersed in tap water (Mg-HW). Recipients were given either regular water (RW), Mg-HW, Bu-HW, or Mg-HW that had been subsequently degassed (DW). Graft survival was assessed by daily palpation for a heartbeat. Drinking Mg-HW or Bu-HW was remarkably effective in prolonging heart graft survival and reducing intimal hyperplasia in transplanted aortas as compared with grafts treated with RW or DW. Furthermore, T cell proliferation was significantly inhibited in the presence of hydrogen in vitro, accompanied by less production of interleukin-2 and interferon- γ . Hydrogen treatment was also associated with increased graft ATP levels and increased activity of the enzymes in mitochondrial respiratory chain. Drinking HW prolongs survival of cardiac allografts and reduces intimal hyperplasia of aortic allografts.

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