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Hydrogen gas treatment prolongs replicative lifespan of bone marrow multipotential stromal cells in vitro while preserving differentiation and paracrine potentials

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Abstract

Cell therapy with bone marrow multipotential stromal cells/mesenchymal stem cells (MSCs) represents a promising approach in the field of regenerative medicine. Low frequency of MSCs in adult bone marrow necessitates ex vivo expansion of MSCs after harvest; however, such a manipulation causes cellular senescence with loss of differentiation, proliferative, and therapeutic potentials of MSCs. Hydrogen molecules have been shown to exert organ protective effects through selective reduction of hydroxyl radicals. As oxidative stress is one of the key insults promoting cell senescence in vivo as well as in vitro, we hypothesized that hydrogen molecules prevent senescent process during MSC expansion. Addition of 3% hydrogen gas enhanced preservation of colony forming early progenitor cells within MSC preparation and prolonged the in vitro replicative lifespan of MSCs without losing differentiation potentials and paracrine capabilities. Interestingly, 3% hydrogen gas treatment did not decrease hydroxyl radical, protein carbonyl, and 8-hydroxydeoxyguanosine, suggesting that scavenging hydroxyl radical might not be responsible for these effects of hydrogen gas in this study.

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