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Protective effects of molecular hydrogen on steroid-induced osteonecrosis in rabbits via reducing oxidative stress and apoptosis

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Abstract

Background: The objective of this study was to investigate the protective effects of molecular hydrogen, a novel and selective antioxidant, on steroid-induced osteonecrosis (ON) in a rabbit model.

Methods: Sixty rabbits were randomly divided into two groups (model group and hydrogen group). Osteonecrosis was induced according to an established protocol of steroid-induced ON. Rabbits in the hydrogen group were treated with intraperitoneal injections of molecular hydrogen at 10 ml/kg body weight for seven consecutive days. Plasma levels of total cholesterol, triglycerides, soluble thrombomodulin(sTM), glutathione(GSH) and malondialdehyde(MDA) were measured before and after steroid administration. The presence or absence of ON was examined histopathologically. Oxidative injury and vascular injury were assessed in vivo by immunohistochemical staining of 8-hydoxy-2-deoxyguanosine(8-OHdG) and MDA, and ink artery infusion angiography. The terminal deoxynucleotidyl transferase-mediated dUTP nick end labeling (TUNEL) assays were performed to measure apoptosis.

Results: The incidence of steroid-induced ON was significantly lower in hydrogen group (28.6%) than that in model group (68.0%). No statistically differences were observed on the levels of total cholesterol and triglycerides. Oxidative injury, vascular injury and apoptosis were attenuated in the hydrogen group compared with those in the model group in vivo.

Conclusions: These results suggested that molecular hydrogen prevents steroid-induced osteonecrosis in rabbits by suppressing oxidative injury, vascular injury and apoptosis.

Keywords: Apoptosis; Molecular hydrogen; Osteonecrosis; Oxidative injury; Vascular injury.

Figures

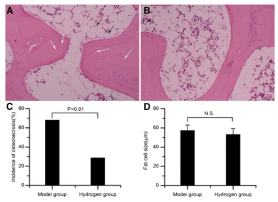

Fig. 1 Histological observation. **a** Representative ON+...

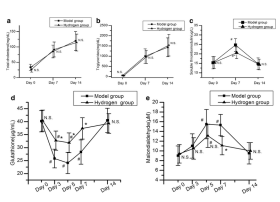

Fig. 2 The levels of total cholesterol...

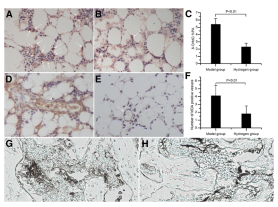

Fig. 3 Oxidative stress and vascular injury...

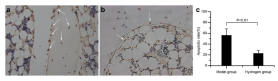

Fig. 4 TUNEL apoptosis detection. **a** The...

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