MOLECULAR HYDROGEN: NEW PROTECTIVE TOOL AGAINST ACUTE KIDNEY INJURY ASSOCIATED WITH CARDIAC SURGERY

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Cardiac surgery-associated acute kidney injury (CS-AKI) is common postoperative complication following cardiac surgery. Since oxidative stress is hypothesized to be one of the causes of CS-AKI, molecular hydrogen (H_2) supplementation has been proposed as a novel and promising antioxidant for the prevention of CS-AKI. Our study was performed on an *in vivo* model of simulated porcine heart transplantation. Animals in the H_2 group received H_2 in gaseous form (3%) during inhalation of anesthesia and throughout oxygenation of blood in extracorporeal circulation. The levels of creatinine, urea, and phosphorus were measured in plasma. Renal tissue samples were analyzed by the Western blot method (Nrf2; Keap-1; SOD) as well as by measuring enzyme kinetics of Na,K-ATPase. After cardiac surgery selected plasma biomarkers were elevated. The use of H_2 was followed by the normalization of all these parameters. Our results suggest activation of Nrf2/Keap1 pathway as well as increased SOD protein expression in the H_2-treated group. Regarding Na,K-ATPase we detected a significant decrease of the V_{max} in the H_2 group. Our results support the effectiveness of H_2 supplementation in CS-AKI, especially in terms of normalization of plasma biomarkers to control levels. The protective effect of H_2 might be linked to its activity against oxidative stress via Nrf2/Keap1 pathway modulation. H_2 treatment resulted in decrease in renal Na,K-ATPase activity indicating decreased sodium reabsorption, which appears to be a novel regulatory mechanism of an important membrane transporter during CS-AKI in the H_2-treated pig model.

Keywords: Molecular hydrogen, Cardiac surgery, Kidney injury, Oxidative stress

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