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Insufflation of hydrogen gas restrains the inflammatory response of cardiopulmonary bypass in a rat model

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Abstract

Systemic inflammatory responses in patients receiving cardiac surgery with the use of the cardiopulmonary bypass (CPB) significantly contribute to CPB-associated morbidity and mortality. We hypothesized that insufflated hydrogen gas (H_2) would provide systemic anti-inflammatory and anti-apoptotic effects during CPB, therefore reducing proinflammatory cytokine levels. In this study, we examined the protective effect of H_2 on a rat CPB model. Rats were divided into three groups: the sham operation (SHAM) group, received sternotomy only; the CPB group, which was initiated and maintained for 60 min; and the CPB + H_2 group in which H_2 was given via an oxygenator during CPB for 60 min. We collected blood samples before, 20 min, and 60 min after the initiation of CPB. We measured the serum cytokine levels of (tumor necrosis factor-α, interleukin-6, and interleukin-10) and biochemical markers (lactate dehydrogenase, aspartate aminotransferase, and alanine aminotransferase). We also measured the wet-to-dry weight (W/D) ratio of the left lung 60 min after the initiation of CPB. In the CPB group, the cytokine and biochemical marker levels significantly increased 20 min after the CPB initiation and further increased 60 min after the CPB initiation as compared with the SHAM group. In the CPB + H_2 group, however, such increases were significantly suppressed at 60 min after the CPB initiation. Although the W/D ratio in the CPB group significantly increased as compared with that in the SHAM group, such an increase was also suppressed significantly in the CPB + H_2 group. We suggest that H_2 insufflation is a possible new potential therapy for counteracting CPB-induced systemic inflammation.

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