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Protection of donor lung inflation in the setting of cold ischemia against ischemia-reperfusion injury with carbon monoxide, hydrogen, or both in rats

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Abstract

Aims: Lung ischemia-reperfusion injury (IRI) may be attenuated through carbon monoxide (CO)'s anti-inflammatory effect or hydrogen (H2)'s anti-oxidant effect. In this study, the effects of lung inflation with CO, H2, or both during the cold ischemia phase on graft function were observed.

Materials and methods: Rat donor lungs, inflated with 40% oxygen (control group), 500ppm CO (CO group), 3% H2 (H2 group) or 500ppm CO+3% H2 (COH group), were kept at 4°C for 180min. After transplantation, the recipients' artery blood gas and pressure-volume (P-V) curves were analyzed. The inflammatory response, oxidative stress and apoptosis in the recipients were assessed at 180min after reperfusion.

Key findings: Oxygenation in the CO and H2 groups were improved compared with the control group. The CO and H2 groups also exhibited significantly improved P-V curves, reduced lung injury, and decreased inflammatory response, malonaldehyde content, and cell apoptosis in the grafts. Furthermore, the COH group experienced enhanced improvements in oxygenation, P-V curves, inflammatory response, lipid peroxidation, and graft apoptosis compared to the CO and H2 groups.

Significance: Lung inflation with CO or H2 protected against IRI via anti-inflammatory, anti-oxidant and anti-apoptotic mechanisms in a model of lung transplantation in rats, which was enhanced by combined treatment with CO and H2.

Keywords: Carbon monoxide; Cold ischemia phase; Hydrogen; Ischemia-reperfusion injury; Lung inflation; Lung transplantation.

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