



# Protection by Inhaled Hydrogen Therapy in a Rat Model of Acute Lung Injury can be Tracked *in vivo* Using Molecular Imaging

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Abstract



References



Citations



Supplementary Data



Suggestions

## ABSTRACT

Inhaled hydrogen gas (H<sub>2</sub>) provides protection in rat models of human acute lung injury (ALI). We previously reported that biomarker imaging can detect oxidative stress and endothelial cell death *in vivo* in a rat model of ALI. Our objective was to evaluate the ability of <sup>99m</sup>Tc-hexamethylpropyleneamineoxime (HMPAO) and <sup>99m</sup>Tc-duramycin to track the effectiveness of H<sub>2</sub> therapy *in vivo* in the hyperoxia rat model of ALI. Rats were exposed to room air (normoxia), 98% O<sub>2</sub> + 2% N<sub>2</sub> (hyperoxia) or 98% O<sub>2</sub> + 2% H<sub>2</sub> (hyperoxia+H<sub>2</sub>) for up to 60 h. *in vivo* scintigraphy images were acquired following injection of <sup>99m</sup>Tc-HMPAO or <sup>99m</sup>Tc-duramycin. For hyperoxia rats, <sup>99m</sup>Tc-HMPAO and <sup>99m</sup>Tc-duramycin lung uptake increased in a time-dependent manner, reaching a maximum increase of 270% and 150% at 60 h, respectively. These increases were reduced to 120% and 70%, respectively, in hyperoxia+H<sub>2</sub> rats. Hyperoxia exposure increased glutathione content in lung homogenate (36%) more than hyperoxia+H<sub>2</sub> (21%), consistent with increases measured in <sup>99m</sup>Tc-HMPAO lung uptake. In 60-h hyperoxia rats, pleural effusion, which was undetectable in normoxia rats, averaged 9.3 gram/rat, and lung tissue 3-nitrotyrosine expression increased by 790%. Increases were reduced by 69% and 59%, respectively, in 60-h hyperoxia+H<sub>2</sub> rats. This study detects and tracks the anti-oxidant and anti-apoptotic properties of H<sub>2</sub> therapy *in vivo* after as early as 24 h of hyperoxia exposure. The results suggest the potential utility of these SPECT biomarkers for *in vivo* assessment of key cellular pathways in the pathogenesis of ALI and for monitoring responses to therapies.

**Keywords:** <sup>99m</sup>Tc-HMPAO; <sup>99m</sup>Tc-duramycin; SPECT imaging; acute respiratory distress syndrome; hyperoxia

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