Stroke Research Directory

Hyperbaric oxygen reduces blood-brain barrier damage and edema after transient focal cerebral ischemia.


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BACKGROUND AND PURPOSE: Hyperbaric oxygen (HBO) has been shown to protect the brain parenchyma against transient focal cerebral ischemia, but its effects on the ischemic microcirculation are largely unknown. We examined the potential of HBO to reduce posts ischemic blood-brain barrier (BBB) damage and edema. METHODS: Wistar rats and C57/BL6 mice underwent occlusion of the middle cerebral artery (MCAO) for 2 hours. Forty minutes after filament introduction, animals breathed either 100% O2 at 3.0 atmospheres absolute (ata; HBO group) or at 1.0 ata (control) for 1 hour in an HBO chamber. In rats, MRI was performed 15 minutes after MCAO and after 15 minutes and 3, 6, 24, and 72 hours of reperfusion. In mice, BBB permeability for sodium fluorescein was measured after 24-hour reperfusion. RESULTS: Increased BBB permeability on postcontrast T1-weighted (T1w) images had a biphasic pattern. HBO reduced volumes and intensity of enhancement. Mean abnormal enhancing volumes were 71+/−10 mm3 (control) versus 47+/−10 mm3 (HBO) at 15 minutes; 111+/−21 mm3 versus 69+/−17 mm3 3 hours; 147+/−44 mm3 versus 83+/−21 mm3 6 hours; 150+/−37 mm3 versus 89+/−14 mm3 24 hours; and 322+/−52 mm3 versus 215+/−21 mm3 72 hours (all P<0.05). Interhemispheric quotients of mean gray values on T1w were at 1.73+/−0.11 versus 1.57+/−0.07 15 minutes; 1.74+/−0.07 versus 1.60+/−0.06 at 3 hours; 1.77+/−0.07 versus 1.62+/−0.06 at 6 hours; 1.79+/−0.10 versus 1.60+/−0.05 at 24 hours; and 1.81+/−0.10 versus 1.62+/−0.07 at 72 hours (all P<0.05). HBO-treated mice had significantly lower posts ischemic BBB permeability than mice treated with either normobaric hyperoxia or room air. Vasogenic edema assessed on T2w images and histologic sections was significantly lower in HBO-treated rats.

CONCLUSIONS: Intras ischemic HBO therapy reduces early and delayed posts ischemic BBB damage and edema after focal ischemia in rats and mice.

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