

Effect of methane inhalation on nitrosative stress during mesenteric ischemia/reperfusion in rats

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The aim was to test the hypothesis that inhaled methane may modulate the evolution of nitroxidation and the reaction of nitrergic neurons to transient gastrointestinal ischemia. The main components of the nitrosative stress reaction were characterized together with quantitative changes of the nitrergic myenteric neurons in adjacent intestinal segments in anesthetized rats (n=124) inhaling normoxic air with or without 2.2% methane. Serosal microcirculatory parameters (intravital videomicroscopy), the relative ratios of nitrergic neurons (immunohistochemistry), xanthine oxidoreductase (XOR) activities, local NO production (EPR technique), nitrite/nitrate (NOX), and nitrotyrosine levels were measured in the duodenum, ileum and colon after the occlusion of the superior mesenteric artery or after ischemia and reperfusion.

The intramural flow stopped completely only in the ileum the ischemic phase. The highest baseline XOR activity was measured in the duodenum, which increased further during ischemia (p<0.05). Here NO and nitrotyrosine levels increased while the NOX level and the nitrergic neuron ratio decreased (from 28.5% to 23.91%). Reperfusion uniformly elevated XOR activity and nitrotyrosine formation, with the highest level attained in the duodenum, where the nitrergic neuron ratio remained depressed. These changes were eliminated in methane-treated animals, the XOR activity decreased in all intestinal segments, and the duodenal nitrergic neuron ratio was re-established to 30.6%.

The risk for nitrosative stress is highest in transiently hypoxic tissues with high endogenous XOR activities. Inhaled methane inhibits XOR thus reduces nitroxidation which leads to the protection of nitrergic neuron population.

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