

A potential role of hyperbaric oxygen exposure through intestinal nuclear factor-kappaB.

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Source

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Abstract

OBJECTIVE:

Recent studies have demonstrated the therapeutic effectiveness and pharmacologic mechanisms of hyperbaric oxygen therapy (HBOT) in the treatment of a systemic shock state. To elucidate the in vivo role of HBOT during sepsis, we evaluated the effects of HBOT on intestinal mucosal injury and bacterial translocation after lipopolysaccharide challenge.

DESIGN:

Experimental study.

SETTING:

First Department of Surgery and Division of Emergency Care, Kagoshima University School of Medicine, Kagoshima, Japan.

SUBJECTS:

: Male rats were treated with lipopolysaccharide by an intraperitoneal route or with lipopolysaccharide and HBOT.

INTERVENTIONS:

The survival rate, small intestinal tissue damage, and bacterial translocation in the HBOT-treated group were compared with those in the untreated group. Moreover, plasma tumor necrosis factor-alpha and nitrite/nitrate concentrations, inducible nitric oxide synthase and myeloperoxidase activities, and nuclear factor-kappaB in ileal mucosa were investigated. HBOT was initiated 3 hrs after lipopolysaccharide challenge and administered as 100% oxygen, at 2.53 x 10 kPa (2.5 atm absolute), for 60 mins.

MEASUREMENTS AND MAIN RESULTS:

When a sublethal dose of lipopolysaccharide (24 mg/kg) was given, the survival rate was much better in the HBOT-treated group (75%) than in the untreated group (33%). HBOT given 3 hrs after lipopolysaccharide injection (10 mg/kg) also lessened the histologic tissue damage of the terminal ileum and the incidence and magnitude of bacterial translocation to mesenteric lymph nodes at 24 hrs after the lipopolysaccharide injection. Moreover, HBOT was able to reduce mucosal inducible nitric oxide synthase and myeloperoxidase activities and plasma nitrite/nitrate concentrations but not serum tumor necrosis factor-alpha concentrations. Immunohistochemical examination revealed that HBOT specifically modified the mucosal nuclear factor-kappaB activation within 4-6 hrs after the injection.

CONCLUSIONS:

HBOT performed 3 hrs after lipopolysaccharide challenge alleviates intestinal barrier dysfunction and improves survival rates. Herein, we propose one possible mechanism for these beneficial effects: HBOT can modify the nuclear factor-kappaB activation in the intestinal mucosa and attenuate the sequential nitric oxide overproduction and myeloperoxidase activation. Consequently, bacterial translocation could be potentially decreased. We believe that the present study should lead to an improved understanding of HBOT's potential role in sepsis.

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