Journal of Hyperbaric Medicine, Vol. 2, No. 3, 1987

Infectious Diseases: Pathophysiology and Mechanisms of Hyperbaric Oxygen

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Mader JT, Adams KR, Sutton TE. Infectious diseases: pathophysiology and mechanisms of hyperbaric oxygen. J Hyperbaric Med 1987; 2(3):133–140.—Hyperbaric oxygen (HBO) therapy has proved adjunctive along with antibiotics and surgery for the treatment of necrotizing soft tissue infections, refractory osteomyelitis, and infected ischemic wounds. The pathophysiology and mechanisms of HBO therapy explain these beneficial effects. Hyperbaric oxygen has a direct bactericidal effect on anaerobic organisms through the production of toxic oxygen radicals. Hyperbaric oxygen increases the oxygen tension in infected tissues which provides oxygen to the polymorphonuclear leukocytes to kill aerobic organisms. Hyperbaric oxygen provides oxygen to the fibroblast to allow new collagen formation and, subsequently, angiogenesis which allows hypoxic infected wounds to heal. Finally, HBO potentiates certain antibiotics such as the aminoglycosides and the sulfonamides.

hyperbaric oxygen, osteomyelitis, Staphylococcus aureus, Pseudomonas aeruginosa, tobramycin, polymorphonuclear leukocytes

Hyperbaric oxygen (HBO) has been used to treat a variety of infectious diseases. The beneficial mechanisms of hyperbaric oxygen include improved oxygen-dependent killing by the polymorphonuclear leukocytes, direct effect of toxic oxygen radicals on microorganisms, improvement in wound healing, and potentiation of certain antibiotics.

Oxygen is necessary for oxygen-dependent killing of microorganisms by the polymorphonuclear leukocytes and macrophages. These cells are the body's first line of defense against bacterial infections. Oxygen-dependent killing is initiated by the respiratory burst of the phagocytes. Its function is to produce a group of highly reactive microbicidal agents from the reduction of oxygen (1). The cornerstone of this reaction is reduced oxygen or superoxide. It is not clear if superoxide by itself is bactericidal, or if its role is to generate more potent oxygen radicals such as hydrogen peroxide, hydroxyl radicals, or singlet oxygen as the principal agents of killing. Regardless of the priority of potency, studies have shown that superoxide, hydrogen peroxide, hydroxyl radical, and singlet oxygen are all too reactive to be tolerated well within the living system (2).