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Effect of Hyperbaric Oxygen on Free Radical Activity in a Patient With Lepromatous Leprosy

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Bertholds M, Andreyev G, Goldstein N. Effect of hyperbaric oxygen on free radical activity in a patient with lepromatous leprosy. J Hyperbaric Med 1989; 4(3):131–134.—Clinical effects and free radical-related biochemical actions of hyperbaric oxygen (HBO) were assessed in a patient with lepromatous leprosy, who had symptoms but was free from bacilli because of prior antimicrobial chemotherapy. Superoxide dismutase in red blood cell lysate and chemoluminescence, as well as malondialdehyde in plasma, were determined along with a series of HBO sessions. Changes in the biochemical and biophysical parameters were consistent with a trend toward enhanced antioxidant activity.

hyperbaric oxygen, leprosy, oxygen-derived free radicals

Introduction

Hyperbaric oxygen (HBO) has been used successfully in patients with Hansens' disease (1, 2). The possibilities however that oxygen-derived free radicals may be generated in excess in this disease in view of deficiencies in the antioxidant system, such as low levels of vitamin C (3), vitamin A, and vitamin E (4), raise the question whether hyperoxia, while killing the microorganism, may enhance free radical damage by lipoperoxidation, and thus harm the host.

Materials and Methods

Eight years ago the patient, a 34-yr-old female, was given a 26-wk course of multidrug chemotherapy for lepromatous leprosy. After the course of treatment she was negative for bacilli but still had manifestations of disease (general malaise, asthenia, frequent upper respiratory infections, subfebrile temperatures, elevated red cell sedimentation rate). We treated the patient with HBO in a monoplace chamber at 2.5 absolute atmospheres, 10, 1-h sessions (every other day). The patient was followed clinically, and assessments were made related to activity of free radicals, superoxide dismutase (SOD) and malondialdehyde (MDA), as a measure of lipoperoxidation in red cell lysate and chemoluminescence (CL) in plasma. The methods used are described by

Table 1: Results of determinations of CL and MDA in plasma[a]

Date, 1988	CL[b]	MDA, μM
12 May before HBO	12.5	0.0470
18 May after three HBO sessions	17.5	0.0564
25 May after six HBO sessions	12.8	0.0480
8 June after 10 HBO sessions	13.5	0.0450

[a]Mean of three measurements in the patient undergoing a series of HBO
[b]In units related to flame upon addition of Fe++.

Lipecka (5) for SOD, by Vladimirov and colleagues (6) for (CL), and by Uchiyama and Michaza (7) for MDA.

Results and Discussion

The SOD content in red cells increased with the HBO treatment, the CL of plasma stabilized at the level of pre-HBO values, and, concomitantly, the MDA concentration in red cells fell to below the baseline value (Table 1 and Fig. 1). These changes are consistent with activation of antioxidant mechanisms in the patient as the HBO treatment was continued beyond three sessions.

Hyperbaric oxygen seems to stimulate the increase of SOD in adaptation to hyperoxia (8) and may oxidize certain cofactors involved in peroxidation (9). Biochemical changes in the patient being given HBO therapy were associated with some clinical improvement: asthenia, malaise, and subfebrile temperatures lessened, and sedimentation rate decreased from 18 to 8 mm/h.

Without claiming a cause-effect relation between the biochemical and clinical events, it may be stated that HBO did not induce or enhance free radical activity in the leprosy patient.

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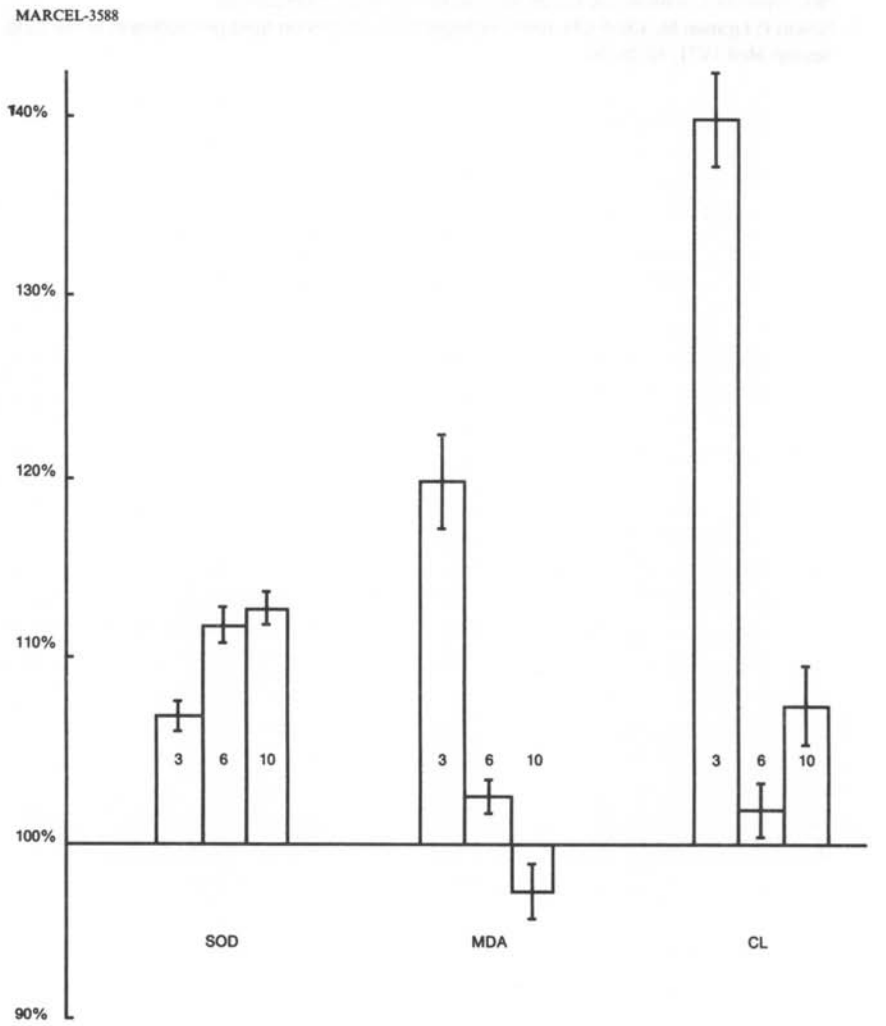

FIG. 1—Changes (in percent from pretreatment values) of SOD, MDA, and CL after 3, 6, and 10 sessions of HBO. Mean values and SD of three measurements.

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