HIV Antiviral Effects of Hyperbaric Oxygen Therapy

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Researchers have speculated that hyperbaric oxygen (HBO) therapy has an antiviral effect in HIV infection. To determine HBO's antiviral effect, the authors performed ex vivo and in vivo quantitative assays on HIV-infected plasma and peripheral blood mononuclear cells (PBMCs) at baseline and after treatment. The authors also HBO-treated uninfected PBMCs and then exposed them to HIV at ambient pressure. HIV viral load was decreased in the infected cells, and few viruses entered uninfected PBMCs exposed to HBO. The results of this study support the theory that HBO has an antiviral effect.

Key words: *HIV infection, hyperbaric oxygen therapy, viral load*

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Scientists have worked toward the development of anti-HIV treatments that can act against the virus while sparing the patient from major toxic side effects. Unfortunately, drugs used to suppress HIV have proved damaging to the host body (Schoub, 1994). Because of the serious side effects and/or failure of these treatments, many persons with HIV/AIDS have sought adjunctive methods. Some PWAs use these interventions exclusively or in combination with conventional therapies (Nokes, Kendrew, & Longo, 1995).

Hyperbaric oxygen therapy has been documented to relieve the chronic, debilitating fatigue associated with HIV, without toxicity (Darko et al., 1992; Reillo, 1993). However, when some researchers speculate about HBO's antiviral actions, they are met with what the hyperbaric community calls the "tomato effect." "The 'tomato effect' in medicine occurs when an efficacious treatment is ignored or rejected because it does not 'make sense' in light of accepted theories of disease mechanism and drug action" (Gottlieb, 1995, p. 5).

Evidence indicates that HBO offers subjective relief from HIV-related debilitation. Theoretically, this correlates with HBO's antiviral effects on HIV.

Methods

The authors' purpose was to determine if HBO: (a) has an antiviral effect on HIV-infected plasma and peripheral blood nuclear cells (PBMCs) ex vivo and in vivo; and (b) makes target cells resistant to HIV invasion.

Ex Vivo

The authors conducted a series of ex vivo laboratory experiments using an animal hyperbaric chamber.

Experiment 1. Free infectious HIV was put in an isotonic solution and then placed in the chamber for 15

minutes and treated with 100% oxygen under pressure (2.5 ATA, 48 feet sea water (FSW). Duplicate quantitative assays revealed baseline HIV viral endpoints of 125 virons per 1 million cells.

Experiment 2. Specimens of uninfected target cells were treated with HBO at 15-minute increments for up to 45 minutes and then exposed to infectious HIV at normal atmospheric pressure. Baseline endpoints were 125 and 625.

Experiment 3. HIV-infected plasma was treated in a hyperbaric chamber for 15-minutes at 48 FSW. Plasma viremia pretreatment endpoints were 125 and 125.

Experiment 4. Infected PBMCs were treated at 60 FSW for 15 minutes. Baseline endpoints were 5 and 5.

In Vivo

The authors performed quantitative assays on patients' plasma before HBO and after three treatments at 2.5 ATA (48 FSW) and on the peripheral PBMCs of patients who had been receiving HBO for two and three years (number of treatments ranged from 200 to 300). These patients were not taking any other antiviral therapy, but they were receiving prophylaxis against *Pneumocystis carinii* pneumonia. To prevent any oxygen-free radical effects of long-term HBO therapy, the patients took an antioxidant therapy, ONDROX, which is well-tolerated.

Results

In the first experiment, the endpoints were 25 and 25 after exposure to HBO.

In the second experiment, target cells treated for up to 30 minutes were infected with all the virus. However, target cells treated for 45 minutes had endpoints of 25 and 25 (Table 1). Exposure to HBO for 45 minutes seemed to make target cells more resistant to HIV invasion.

In the third experiment, plasma viremia endpoints after treatment were 5 and 25.

In the fourth experiment, post-HBO endpoints were 5 and 5.

Table 1. Quantitative Endpoints: HIV Entry into PBMCs after HBO

Specimen	Exposure	Endpoints*
1	48 ft; 0 min	125, 625
2	48 ft; 15 min	125, 625
3	48 ft; 30 min	625, 625
4	48 ft; 45 min	25, 25

* Virons per 1 million cells

The results of the in vivo experiments seemed to indicate that HBO eliminated traceable HIV virus in the plasma of infected patients, even on a long-term basis and in the absence of other antiviral therapy (Tables 2 & 3).

The patients have remained free of opportunistic infections, experienced relief from fatigue, and maintained their body weight.

Conclusions

These preliminary results indicate HBO's antiviral effect on HIV in the body and in the laboratory. Theoretically, this effect may be the result of biochemical inactivation of HIV and/or immune stimulation, which induces cytotoxic activity. Less virus in the plasma reduces the likelihood that uninfected target cells will be infected.

Table 2. Quantitative HIV Endpoints in Plasma

Patient	Baseline	Post HBO	CD4 Count	# TXs	Time
1	125, 125	5, 5	2	3	1 wk
2	5, 5	<5*, <5*	300	3	1 wk
3		5, 5	0	300	3.5 yrs
4		<5*, <5*	150	300	3.5 yrs
5		<5*, <5*	0	200	2 yrs
6	3125,3125	<5*, <5*	18	3	1 wk

* Fewer than 5 virons per million cells is considered a negative assay.

Table 3. Quantitative HIV Endpoints in PBMCs of Long-term Patients

Patient	Post HBO	CD4 Count	# TXs	Time
1	<5*, <5*	150	350	3.5 yrs
2	<5*, <5*	0	350	3.5 yrs
3	<5*, <5*	200	350	3.5 yrs
4	<5*, <5*	200	350	3.5 yrs
5	<5*, <5*	30	350	3.5 yrs
6	<5*, <5*	600	350	3.5 yrs

* Fewer than 5 virons per 1 million cells is considered a negative assay.

Additionally, exposure to HBO may prolong the life of cells and slow the progression of disease by creating an oxidative effective that inhibits viral binding and entry. This supposition is supported by decreased viral entry of a known amount of HIV when exposed to PBMC's treated with HBO.

These results underscore the need to research using each patient as his/her control, because viral load and clinical disease is variant. Such studies will establish HBO's role in HIV antiretroviral therapy.

References

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