EFFECT OF HYPERBARIC OXYGEN THERAPY ON FATIGUE IN PATIENTS WITH MULTIPLE SCLEROSIS

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Abstract. Introduction. Fatigue is one of the most disabling symptoms in patients with MS. The usefulness of HBOT has been evaluated for the last 20 years.
Objective. To study the effect of HBOT on MS-related fatigue.
Material and methods. Twenty one patients with clinically definite MS according to McDonald's criteria underwent HBOT. Neurological examination, EDSS assessment, fatigue evaluation, and statistical analysis were performed.
Results. All individuals had fatigue improvement after HBOT. Clinical response was better in younger patients, RR MS, lower EDSS, and shorter fatigue duration.
Conclusion. We suggest that HBOT improves fatigue and has no side effects.
Key words: multiple sclerosis, fatigue, hyperbaric oxygen therapy, outcome

INTRODUCTION

Multiple Sclerosis (MS) is an autoimmune, inflammatory disease of the nervous system associated with demyelination of the axons and damage to the blood-brain barrier that contributes to the development of edema and oxygen deficiency [6, 7]. According to the literature, breathing pure oxygen under increased pressure (hyperbaric oxygenation) raises oxygen concentrations in blood plasma and counteracts the hypoxia by elevating tissue $p0_2$, improves the microcirculation, and cerebral metabolism [5, 8, 9]. This rationalizes the use of HBOT as a part of a complex treatment of MS patients presenting with different clinical symptoms among which fatigue is one of the most common and disabling. Therefore, we decided to study the effect of HBOT on MS-related fatigue.

MATERIALS AND METHODS

Twenty one patients (17 female and 4 male) with clinically definite MS according to McDonald's criteria were included and evaluated in our uncontrolled study. The group was heterogeneous according to the patients' age, MS form, disease and fatigue duration (Table 1). Sixteen patients had relapsing-remitting (RR) form of the disease and five - secondary progressive (SP) MS. Total mean age was 41,4±12.6 years. Average disease and fatigue durations were respectively 6.5+3.2 years and 4.1 ±2.8 years.

Table 1. Common patients and disease characteristics.

MS form	Sex		Age	MS duration	Fatigue duration	EDSS
	F	M				
RR	13	3	40.4 ± 10.8	5.4 ±2.1	5.4 ± 2.4	3.0 ±0.8
SP	4	1	44.6 ± 6.4	9.9 ±2.7	9.9 ±3.6	5.2 ±0.7
Total	17	4	41.4+12.6	6.5 ±3.2	4.1 ±2.8	3.5 ± 1.2

All patients in the study were treated with HBOT in multiplace barochamber. The duration of the HBO-session was one hour and 20 minutes: 10 minutes for compression, 10 minutes for decompression and 1 hour for breathing pure oxygen by mask at 2.5-2.8 ATA. HBOT was given once a day. The first 10 HBO-sessions were carried out every day and the following ten sessions were received once every two days to a total of 20 treatments.

Neurological examination, EDSS assessment, fatigue questionnaire-based evaluation scale from 0 to 10 and statistical analysis were applied. Patients were interviewed immediately before and after the HBOT course.

RESULTS

The analysis of our data (Table. 2) showed that patients with RR MS presented with lower EDSS (3), shorter duration of fatigue symptom (5) and better initial fatigue score (4.5). Patients with SP MS presented with higher EDSS (5.2), longer duration of fatigue (9.9) and worse initial fatigue score (7.0).

Symptomatic improvement of fatigue was observed in all twenty one individuals after HBOT. Clinical response was better (distinguished decrease of fatigue score) in younger patients, RR MS, less advanced disease, lower EDSS, and shorter fatigue duration.

Table 2. Individual c inical characteristics of patients

№	Patient	Sex	Age	MS form	EDSS score	Fatigue duration (years)	Fatigue score	
							before HBOT	after HBOT
1.	N.S.K.	F	45	RR	3.5	4.5	4.0	2.0
2.	D.M.L	F	29	RR	3.0	2.0	4.0	1.5
3.	B.S.A	F	23	RR	2.5	2.5	3.5	1.0
4.	N.A.S.	M	40	RR	2.0	3.0	3.0	0
5.	R.D.L.	F	42	RR	3.0	5.5	4.0	1.5
6.	M.D.E.	F	60	RR	4.5	8.5	4.5	2.0
7.	J.P.K.	M	24	RR	3.0	2.0	3.5	0
8.	P.I.S.	F	48	RR	3.5	6.0	4.5	1.5
9.	M.S.K.	F	61	RR	4.0	18.0	5,0	2,5
10.	Z.S.D.	M	39	RR	2.0	3.0	3,0	1,0
11.	Z.S.I.	F	44	RR	4,5	9.0	4.0	1.5
12.	M.V.T.	F	51	RR	4.0	10.0	4.5	2.0
13.	T.Z.T.	F	45	RR	2.0	5.0	3.0	1.0
14.	I.D.G.	F	38	RR	2.0	2.0	3.0	0
15.	I.N.B.	F	37	RR	2.0	3.0	3.5	1.0
16.	P.D.K.	F	21	RR	2.5	3.0	4.0	1.5
17.	M.I.V.	F	39	SP	5.5	6.5	6.5	3.5
18.	M.D.T.	F	51	SP	5.0	8.5	6.0	4.0
19.	T.D.I.	F	33	SP	5.0	15.0	7.5	4.5
20.	P.M.T.	M	60	SP	4.5	12.0	7.0	4.5
21.	E.K.I.	F	40	SP	6.0	7.5	6.5	3.5

The analysis of variance showed statistically significant difference ($P<0.05$) in the average values of fatigue score in patients before and after HBOT (Table. 3).

Table 3. Fatigue score according to MS type before and after HBOT.

MS form	Fatigue rating		Statistical differences (P)
	before HBOT	after HBOT	
RR	3.8 + 1.2	1.3 ±0.7	$P < 0.05$
SP	6.6 ±0.8	4.0 ±0.5	$P < 0.05$

DISCUSSION

Multiple sclerosis is an autoimmune, inflammatory disease that may affect any area of the nervous system, thus causing a wide variety of symptoms such as visual problems, weakness, numbness, urologic dysfunction, fatigue, depression, neuropathic pain and cognitive disturbances [6, 13]. Various treatment protocols including drugs (corticosteroids, interferons, etc.) and alternative medical approaches are applied in accordance with the clinical symptoms, formp and stage of the disease.

Fatigue is one of the most common and disabling symptoms of MS, occurring in about 80% of people [6]. Recent options for dealing with MS-related fatigue include occupational and physical therapy, sleep regulation, psychological interventions, heat management and medications [7].

Although hyperbaric medicine is a relatively new medical branch, the therapeutic efficacy of oxygen in treatment of particular diseases has been reported since 1917. As it is known from the available literature the physiologic rationale for oxygen use is based on the following effects: restoration

and amelioration of tissue cells function dependent of oxygen, diffuse increment of oxygen quantity in the tissues due to dissolved oxygen in plasma, direct antiedematous effect, immunosuppressive effect, elevation of antioxidative enzymes and prevention tissues oxidative damage [2, 5]. The usefulness of HBOT, a non-invasive therapy with anti-ischemic and stimulant effect on the central nervous system, has been studied extensively for the last 20 years. Several clinical trials revealed a positive HBOT impact on different MS symptoms like fatigue, mobility, balance and bladder function [1, 4, 8, 9, 10, 12].

The statistical analysis of our results confirmed the positive effect of HBOT, despite the non-homogeneity of the studied groups and the skepticism expressed in the literature [2]. Fatigue relief was observed in all cases, in accordance with previous reports [3, 11, 14, 15].

CONCLUSION

Based on the literature review and our own notices, we suggest that HBOT influencing hypoxia, stimulating the nervous, and regulating the immune systems improves fatigue and has no side effects. This study reveals the beneficial role of HBOT and argues its clinical application as an adjunctive treatment in patients with MS.

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