Immunocorrective Effects of Magnetostimulation in Children Suffering from Recurrent Respiratory Tract Infections

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Summary

The group of 40 children (age 4 – 10 years) suffering from recurrent respiratory tracts infections (no less than 4 episodes during 6 months) was selected for the study. They all received routine antiinfective, antiinflammatory and antipyretic treatment. In addition, 20 of them were treated with magnetostimulation receiving 10 daily expositions (circular applicator around the chest) of homogenous low frequency magnetic field generated by Viofor JPS apparatus. The patients were tested clinically and immunologically before the treatment, after the magnetostimulation and 6 months later. The number and duration of infective episodes as well as the nedd of antibiotic administration decreased significantly in the group exposed to magnetostimulation. The immunological tests showed in this group significant improvement of T cell immunoregulatory functions (IL-10 production, suppressive activity) and proliferative activities in response to mitogens. The elevated immunogenic activity of monocytes and IL-1β production decreased after magnetostimulation. The results suggest that homogenous low frequency magnetic field activates the thymic-dependent process of reinforcement of multifunctional T lymphocyte population, improving on this way defence abilities of immune system.

Introduction

Recurrent and prolonged infections of respiratory tracts belong to most common symptoms of decreased immune defence of the organism. The immune system responds to consequtive infections with vigorous immunogenic but low immunocompetent activities. This is reflected in vitro by high proinflammatory (IL-1β) and low antiinflammatory (IL-1ra) monokine production. The index of monocyte activity tested in PBMC cultures (LM index) represents high values but immunoregulatory activities of T cells are deficient [1, 2]. The imbalance between immunogenicity and immune competence is additionally enlarged by the side effects of repeatedly administered antibiotics and intiinflammatory drugs. They supress the thymic-dependent supplementation of immune system with matured and efficient multifunctional Tcells [3 – 5].

To improve the therapeutic results and to disrupt the vicious circle of recurrent infections, different immunotropic ways of treatment were tested. The promising results were reported after the administration of thymomimetic drugs or thymic hormones [6, 7]. The clinical results of therapeutic administration of homogenous, low frequency magnetic field, generated by Viofor JPS device, indicate on its analgestic, intiinflammatory, regenerative, sedative and anti-stressor influences [8].

To check if the magnetostimulation may exert the positive effects on the thymic-dependent competence of immune system and improve its defence abilities, we have introduced this way of treatment to the routine therapy of children with recurrent respiratory tract infections.

Material and Methods

The group of 40 children (age 4 – 10 years) suffering from frequent respiratory infections (no less than 4 episodes during 6 months) was selected for the study. They all received routine antiinfective, antiinflammatory and antipyretic treatment. In addition, 20 of them were treated with magnetostimulation. They received daily expositions (10 during the 14 days), each 15 min according to M1P2 programme of Viofor JPS low frequency magnetic field generator with the use of large ring applicator around the chest. The induced homogenous magnetic field represented basic pulses frequency of 180 – 190 Hz and magnetic induction B = 3,2 μT (mean) and = 40mT(at the peak of pulse). Our patients were tested clinically and immunologically before the treatment, after the magnetiostimulation was finished and 6 months later.

The immunological tests comprised : 1.) in microcultures of PBMC estimations of response to PHA and to Con A, saturation of IL-2 receptors, T-cell suppressive activity (SAT index), monocyte activity in IL-1β and IL-1ra monokine production (LM index) [1], 2.) in microculture supernanatants quantitative determination of chosen cytokines (IL-1β,

IL-1ra, IL-4, IL-10, IL-13) (ELISA Quantikine kits) and 3.) in PBMC population detection of particular cellular phenotypes (CD4, CD8, CD16/56, CD19, CD3/HLA-DR) (flow cytometry).

Results

The immune deficits of T cell competence (low mitogenic response, low saturation of IL-2 receptors), deficient regulatory T cell abilities (low values of SAT index and IL-10 concentration in culture supernatants) and elevated immunogenic activities of monocytes (high value of LM index and IL-1β concentration) were observed in the all our patients before the treatment (table 1 and 2). The tested cellular phenotypes of PBMC populations represented normal values. In the group of children which received routine treatment only, the immune characteristics remained like before the therapy. In contrast to that the all members of the group exposed to magnetostimulation, represented improved values of immunocompetent (T cell features) and immunogenic (monocyte activities) parameters. In this group, but not in the group treated routinely, the number, severity and duration of infective episodes diminished significantly (the number droped from 5,3 ± 1,3 to 0,25 ± 0,4 and

Table 1. The parameters of evaluation of T cell immune competence in PBMC cultures in the group of children treated with magnetostimulation and in the control group.

The group of children		Paramtr of T cell immune competence			
		Response to PHA (dpm x 10^3/cult)	Response to Con A (dpm x 10^3/cult)	Saturation of IL-2 receptors (%)	SAT index (%)
Control N = 20	Before treatment	64,3 ± 18,3	43,2 ± 16,2	76,3 ± 13,4	12,6 ± 11,3
	After Treatment	67,6 ± 17,4	42,1 ± 18,6	79,8 ± 19,6	14,6 ± 8,7
Statistical significance		N.S.	N.S.	N.S.	N.S.
Treated with magneto-stimulation N = 20	Before treatment	69,8 ± 24,6	47,0 ± 19,7	78,3 ± 12,4	15,8 ± 11,2
	After Treatment	83,0 ± 21,7	62,2 ± 14,3	89,9 ± 11,3	31,2 ± 14,4
Statistical significance		p = 0,340	p < 0.05	p < 0,05	p < 0,05

Table 2. Parameters estimating the immunogenic activity of monocytes (LM index) and the production of chosen cytokines in PBMC cultures in the group of children treated with magnetostimulation and in the control group.

The group of children		The tested parameter			
		LM index	IL-1β (pg/ml)	IL-1ra (pg/ml)	IL-10 (pg/ml)
Control N = 20	Before treatment	29,7 ± 18,4	680 ± 168	2150 ± 1513	29,9 ± 18,3
	After treatment	28,2 ± 19,4	742 ± 186	2370 ± 1290	33,6 ± 15,7
Statistical significance		N.S.	N.S.	N.S.	N.S.
Treated with magneto-stimulation N = 20	Before treatment	26,1 ± 16,9	574 ± 211	2304 ± 1510	39,9 ± 20,3
	After treatment	16,6 ± 12,9	444 ± 111	2507 ± 1177	59,6 ± 23,2
Statistical significance		$p < 0,05$	$p < 0.05$	N.S.	$p < 0,05$

the duration diminished from 10,0 ± 2,4 to 1,2 ± 2,2 days) at the end of observation (table 3).

Conclusions

Our observations suggest that homogenous low frequency magnetic field may improve the thymic dependent immunocompetent functions of T lymophocytes which, in consequence, increases the defence ability of the immune system. The observation needs further investigation.

Table 3. Susceptibility to infections of respiratory tracts in the tested group of children 6 months before and after the treatment with magnetostimulation.

The tested parameter	Before treatment	After treatment
Number of infections	5,3 ± 1,3	0,25 ± 0,4
Duration of infection (days)	10,0 ± 2,4	1,2 ± 2,2
The need of administration of antibiotics and/or steroids	70%	30%

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