

Clinical and Immunological Effects of Magnetostimulation in Children with Recurrent Infections of Respiratory Tracts

Abstract. 40 children with recurrent infections of respiratory tracts were routinely treated antiinfectively. 20 of them additionally received magnetostimulation. The number and duration of infective episodes decreased significantly in the second subgroup. The results indicate that homogenous low frequency magnetic field stimulates the thymic-dependent maturation of T lymphocytes improving defensive abilities of immune system.

Streszczenie. 40 dzieci z nawracającymi infekcjami dróg oddechowych otrzymało rutynowe leczenie przeciwniektynne. 20 spośród nich otrzymało dodatkowo leczenie magnetostymulacją. W tej podgrupie liczba infekcyjnych epizodów i czas ich trwania uległy znaczniejszej redukcji. Wyniki wskazują, że homogenne pole magnetyczne o niskiej częstotliwości pobudza proces grasiczo-zależnego dojrzewania limfocytów T poprawiając obronę sprawność układu odpornościowego. (Efekty kliniczne i immunologiczne magnetostymulacji u dzieci z nawracającą infekcją dróg oddechowych)

Keywords : recurrent infections, magnetostimulation, defensive abilities of immune system.

Słowa kluczowe: nawracające infekcje, magnetostymulacja, obronna zdolność układu odpornościowego.

Introduction

Recurrent and prolonged infections of respiratory tracts belong to the most commonly recognized symptoms of decreased immune defensive abilities of the organism.

To improve the therapeutic results and to disrupt the vicious circle of recurrent infections, many different immunotropic ways of treatment were undertaken. The clinical results of therapeutic administration of homogenous, low frequency magnetic field, generated by Viofor JPS device, indicate on its analgesic, antiinflammatory, regenerative, sedative and anti-stressor influences [1]. Such a wide spectrum of influences suggests that magnetostimulation can influence the homeostatic functions of neuro-endocrine immune network, including the defensive abilities of immune system [2-4]. The efficiency of defensive, tolerogenic and regenerative functions of immune system mainly depends on the undisturbed processes of thymic-driven maturation and delivery of the multifunctional population of T lymphocytes [4-7].

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

Material and methods

40 children (age 4 – 10 years) with frequent respiratory infections (no less than 4 episodes during 6 months) was selected for the study. 20 of them, in addition to the routine antiinfective, antiinflammatory and antipyretic treatment were also treated with magnetostimulation.

They received daily expositions (10 during the 14 days, 15 min each), according to M1P2 programme of Viofor JPS low frequency magnetic field generator, with the use of a large ring applicator around the chest. The induced homogenous magnetic field represented basic pulses frequency of 180 – 190 Hz and magnetic induction $B = 3,2 \mu\text{T}$ (mean) and $= 40\mu\text{T}$ (at the peak of pulse). Our patients were tested clinically and immunologically before the treatment, after the magnetostimulation was finished and 6 months later.

The immunological tests comprised: 1.) in microcultures of mononuclear cells separated from the

blood (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-1 β and IL-1ra monokine production (LM index), and 2.) in microculture supernatants quantitative determination of chosen cytokines (IL-1 β , IL-1ra, IL-10,) (ELISA Quantikine kits). The detailed description of the methods was published earlier [8-10].

Table 1. Frequency of infections of respiratory tracts in the group of children treated with magnetostimulation.

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

Results

In the group which received magnetostimulation, but not in the group treated routinely, the number, severity and duration of infective episodes diminished significantly (the number dropped from 5,3 \pm 1,3 to 0,25 \pm 0,4 and the duration shortened from 10,0 \pm 2,4 to 1,2 \pm 2,2 days) at the end of observation (Table 1.).

Before the treatment all our patients demonstrated 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-1 β concentration). In the group of children which received routine treatment only, the immune characteristics remained not changed after the treatment. In contrast to that the patients of the group exposed to magnetostimulation, represented improved values of immunocompetent (T cell features) and immunogenic (monocyte activities) parameters (Table 2. and Table 3.).

Discussion

The use of large ring applicator of Viofor JPS situated around the chest of the patient creates the possibility of direct influence of homogenous magnetic field on the thymus, which is located inside the mediastinum. The thymus is a

lymphopoietic organ responsible for delivery of matured T lymphocytes to the peripheral immune system [4-7]. Their presence in peripheral blood may be detected in the microcultures of PBMC by the observation of a proper ability to respond the mitogenic stimulation (PHA, ConA), proper values of T lymphocyte suppressive activity (SAT index), full saturation of IL-2 receptors and efficient production of IL-10 [8-10]. These properties of T cells improved significantly in the group of children after magnetostimulation. Concomitantly, the previously excessive immunogenic functions of monocytes (high values of LM index, elevated production of IL-1 β), responsible for pro-inflammatory activities of immune system, considerably diminished. These thymic-dependent, magnetostimulation-induced changes in immune cell population resulted in increased defensive properties of immune system, reflected by reduced number of infective episodes in our patients. It is, therefore, logic to expect, that low frequency, homogenous magnetic field, administered in the way described above, is able to exert immunocorrective influence on the process of thymic-dependent process of T lymphocyte maturation.

Table 2. Parameters of immune competence of T lymphocytes in PBMC cultures of the children of control group and the group treated with magnetostimulation.

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

Table 3. Immunogenic activity of monocytes (LM index) and concentration of chosen cytokines in PBMC cultures of the children of control group and the group treated with magnetostimulation

The group of children		Assessed parameters of immune competence of T lymphocytes			
		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 \pm 18,3	43,2 \pm 16,2	76,3 \pm 13,4	12,6 \pm 11,3
	After treatment	67,6 \pm 17,4	42,1 \pm 18,6	79,8 \pm 19,6	14,6 \pm 8,7
Statistical significance		N.S.	N.S.	N.S.	N.S.
Treated with magnetostimulation N = 20	Before treatment	69,8 \pm 24,6	47,0 \pm 19,7	78,3 \pm 12,4	15,8 \pm 11,2
	After treatment	83,0 \pm 21,7	62,2 \pm 14,3 ↑	89,9 \pm 11,3 ↑	31,2 \pm 14,4 ↑
Statistical significance		p = 0,340	p < 0,05	p < 0,05	p < 0,05

Conclusions

Our observations suggest that homogenous low frequency magnetic field may improve the thymic dependent immunocompetent functions of T lymphocytes and decrease the excessive proinflammatory immunogenic activities of monocytes. In consequence, the magnetostimulation increases the defensive ability of immune system.

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