SAEM 2008 – The Second Symposium on Applied Eelctromagnetics
& PTZE'08 – XVIII Symposium PTZE

Zamość, Poland, June 1-4, 2008

CLINICAL AND IMMUNOLOGICAL EFFECTS OF MAGNETOSTIMULATION IN CHILDREN WITH RECURRENT INFECTIONS OF RESPIRATORY TRACTS

Marek P. Dąbrowski [1], Wanda Stankiewicz [1], Wojciech Witkowski [2], Anna Jung [2], Bolesław Kalicki [2], Janusz Żuber [2]

[1]Military Institute of Hygiene and Epidemiology and [2]Military Medical Istitute
00909 Warsaw, Szaserów 128, Poland, E-mail M.Dabrowski@wihe.waw.pl

Abstract

40 children with reucrrent infections of respiratory tracts were treated routinely (antiinfectively and antiinflammatory) and 20 of them additionally received magnetostimulation (10 daily expositions to homogenous low frequency magnetic field generated by Viofor JPS). They were tested clinically and immunologically before treatment, after the magnetostimulation and 6 moths later. The number and duration of infective episodes decreased significantly after magnetostimulation. In this subgroup the immunoregulatory functions of T lymphocytes improved and excessive proinflammatory immunogenic activity of monocytes decreased. The results indicate that homgenous low frequency magnetic field stimulates the thymic-dependent maturation of T lymphocytes improving defensive abilities of immune system.

Introduction

Recurrent and prolonged infections of respiratory tracts belong to the most commonly recognised 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 analgestic, intiinflammatory, regenerative, sedative and anti-stressor influences [1]. Such a wide spectrum of influences my 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 μT (mean) and = 40μT (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-1β and IL-1ra monokine production (LM index), and 2.) in microculture supernanatnts quantitative determination of chosen cytokines (IL-1β, IL-1ra, IL-10,) (ELISA Quantikine kits). The detailed description of the methods was published earlier [8-10].

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 ± 1,3 to 0,25 ± 0,4 and the duration shortened from 10,0 ± 2,4 to 1,2 ± 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-1β 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 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]. They presence in peripheral blood may be detected in the microcultures of PBMC by the 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-1β), responsible for pro-inflammatory activities of immune system, considerably dropped. 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.

Conclusions

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

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 ± 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%

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		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 ± 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 = 40	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 3. Immunogenic activity of monocytem (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 parameter			
		LM index	Concentration of IL-1β (pg/ml)	Concentration of IL-1ra (pg/ml)	Concentration of 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.
Leczona magneto-stymulacją N = 40	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

References

[1] Sieroń A. (ed.), Application of electromagnetic fields In medicine (in polish). Bielsko-Biała, α-Medica Press, 2002.

[2] Savino W., Arzt E., Dardenne M., Immunoneuroendocrine connectivity: the paradigm of the thymus-hypothalamus/pituitary axis. Neuroimmunomodulation, 6, 126-136, 1999.

[3] Besedovsky H., Sorkin E., Network of immune-neuroendocrine interactions. Clin. Exp. Immunol. 21, 1-5, 1977.

[4] Dąbrowski M.P., Dąbrowska-Bernstein B.K., Immunoregulatory role of thymus, Boca Raton Fl., CRC Press, 1990, 131-183.

[5] Dąbrowski M.P., Immune system – your personal doctor (in polish), Warszawa, Sanmedia, 1994.

[6] Jamieison B.D., Douk D.C., Killian S. et al., Generation of functional thymocytes in the human adult. Immunity, 10, 569-573, 1999.

[7] Seddon B., Mason D., The third function of the thymus. Immunol. Today, 21, 95-98, 2000.

[8] Dąbrowski M.P., Stankiewicz W., Kubacki R. et al., Immunotropic effects in cultured human blood mononuclear cells pre-exposed to low-level 1300 MHz pulse-modulated microwave field., Electromagnetic Biol. Med., 22, 1, 1-13, 2003.

[9] Dąbrowski M.P., Stankiewicz W., Płusa T. et al., Competition of IL-1 and IL-1ra determines lymphocyte response to delayed stimulation with PHA., Mediators of Inflammation, 10, 101-107, 2001.

[10] Stankiewicz W., Dąbrowski M.P., Chciałowski A. et al.., Cellular and cytokine immuoregulation in patients with chronic obstructive pulmonary disease and brochial asthma. Mediators of Inflammation, 11, 307-312, 2002.