



## Influence of Magnetic Vibration Heating Massage on Erectile Dysfunction in Patients with Chronic Nonbacterial Prostatitis

D.G. Korenkov<sup>1</sup>, V.E. Marusanov<sup>2</sup>

<sup>1</sup> Department of Urology,

<sup>2</sup> Department of Emergency Medicine of the North-western State Medical University named after I.I. Mechnikov of the Ministry of Health of the Russian Federation; 41 Kirochnaya St., Saint Petersburg, 191015, Russia

Contacts: Dmitry Georgievich Korenkov [dkoren@mail.ru](mailto:dkoren@mail.ru)

27 patients with chronic nonbacterial prostatitis and erectile dysfunction were enrolled into the study.

**The aim of the study** was to examine the effect of transrectal magnetic vibration heating massage performed using MAVIT® (ULP-01 - "ELAT") device causing changes in the levels of proinflammatory cytokines in the prostate (prostate) and blood plasma, as well as changes in hemodynamics in the prostate and improvement of erectile dysfunction. The control group consisted of 10 virtually healthy men aged 23-45. The study was performed before and after the course of treatment (10 sessions), as well as 30 days after the last session of magnetic vibration heating massage.

The study revealed that the sluggishly progressing inflammatory process is supported by proinflammatory cytokines produced in the prostate. The use of magnetic vibration heating massage of the prostate led to improvement of its microcirculation, an increase in testosterone levels and restoration of erectile function in 27 patients with chronic nonbacterial prostatitis.

**Keywords:** chronic nonbacterial prostatitis, proinflammatory cytokines, erectile dysfunction, magnetic vibration heating massage of prostate

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Cytokines profile changers after magnetic-heat-vibromassage in chronic nonbacterial prostatitis with erectile disfunction

D.G. Korenkov<sup>1</sup>, V.E. Marusanov<sup>2</sup>

Department of Urology,

<sup>2</sup> Department of Emergency Medicine of the North-western State Medical University named after I.I. Mechnikov of the Ministry of Health of the Russian Federation;

41 Kirochnaya St., Saint Petersburg, 191015, Russia

The aim of the study was to examine the influence of magnetic-heat-vibromassage procedure in treatment of 27 patients with chronic nonbacterial prostatitis with erectile dysfunction, by means of transrectal electrodes application of MAVIT® apparatus (ULP-01 - "ELAT"). In the prostatic gland (PG) media and blood plasma the pro-inflammatory cytokine concentrations was investigated. PG hemodynamic, and erectile dysfunction also was determined. Control group was presented by 10 healthy males (23—45 years old). Measurements were done before treatment, and after 10 procedures of PG massage, and 30 days after procedure.

It was shown that chronic nonbacterial prostatitis with erectile dysfunction with low clinical performance is supported by pro-inflammatory cytokines produced by the PG. The usage of magnetic-heat-vibromassage procedure increased prostatic microcirculation, as well as testosterone level, and improved the erectile dysfunction in all 27 patients enrolled into the study.

**Key words:** chronic nonbacterial prostatitis, pro-inflammatory cytokine, erectile disfunction, magnetic-heat-vibromassage of prostatic gland

### Introduction

Chronic nonbacterial prostatitis (CNP) (category IIIB according to the National Institutes of Health) is one of the most common diseases in men aged 30-40. Since the beginning of the 80s of the last century, most

researchers began to note persistent prolonged course of the pathological process in patients who did not have bacterial flora seeded in the prostate gland secretions [1, 2]. These patients often have psychological, emotional, behavioral, cognitive problems, and problems with

social adaptation, which forces them to repeatedly seek medical help. CNP reduces men's quality of life and negatively affects their sexual life, thereby disrupting family relationships.

Despite a large number of publications on the etiology, pathogenesis, and pathophysiology of CNP, the disease is still insufficiently studied and poorly treatable [3-7]. There are various theories about the origin and mechanism of the development of CNP. Erectile dysfunction in this category of patients is found in 35-59 % of cases [8]. Many authors note high incidence of erectile dysfunction cases in patients with CNP [9, 10]. One of the reasons for the deterioration of libido in these patients is the decrease in the concentration of testosterone in the blood serum [11]. Studies revealed direct correlation between the level of sex hormones and the strength of sexual drive in men [12].

The variety of subjective and objective symptoms associated with pancreatic inflammation makes it difficult to diagnose it, and generally accepted clinical and laboratory methods of examination do not always allow us to confirm the presence of inflammatory processes in the organ [13]. Recently, various physiotherapy procedures (magnetotherapy, thermotherapy, electrophoresis, laser therapy, etc.) have been used in combination with medications in order to improve the effectiveness of treatment of patients with CNP [14].

In our opinion, the most significant cause of CNP among many others is the increased level of proinflammatory cytokines in the prostate. It is well known that cytokines are activated in the lesion during any inflammatory process, including pancreatitis, under the influence of bacterial antigens. Cytokines are peptides and proteins produced by cells that are responsible for short-term regulation of intercellular and crosssystem interactions that determine survival capacity of the cells, stimulation and inhibition of their growth, their functional activity and apoptosis.

Proinflammatory cytokines (Interleukin (IL) 6, IL-1b, IL-8, tumor necrosis factor alpha (TNF-a) and interferon gamma (IFN- $\gamma$ )) increase membrane permeability and activate vascular-platelet hemostasis with formation of microtrombi in the pancreatic microcirculation, which contributes to increased swelling of tissue and vasodilation in the affected organ due to intensification of the synthesis of nitric oxide from the endothelium of the microcirculation system. The proinflammatory cytokines IL-6 and IL-8 play an important role in the organism's response to bacterial infection. IL-8 acts as a powerful chemoattractant of neutrophils responsible for migration of these cells into the infected pancreatic tissue for the purpose of protection against the invading pathogens. Proinflammatory cytokines are involved in development of

local immunity during inflammatory processes [15, 16].

It can be assumed that with a decrease in the intensity of the inflammatory process under the influence of the given therapy, production of cytokines in the affected organ continues but at a lower rate, which is yet sufficient to maintain sluggish inflammation in the prostate.

In our opinion, the use of the Russian-made device MAVIT® (ULP-01 - "ELAT") is the most appropriate approach. Its influence is based on the local (transrectal) effect of several physical and therapeutic factors (Magnetic Vibration Heating Massage Device) on the prostate.

**The aim of the study** was to examine the effect of magnetic vibration heating massage performed with MAVIT® causing changes in the level of proinflammatory cytokines in blood plasma and pancreatic secretions, as well as in hemodynamics in the prostate in patients with CNP and erectile dysfunction.

### Materials and Methods

27 patients, aged 23-49, with latent stage of CNP complicated by erectile dysfunction were enrolled into the study (main group). All patients with CNP had complaints of sexual disorders. The patients had CNP and erectile dysfunction for 4-9 years, and 3-6 years, respectively. The control group consisted of 10 virtually healthy men aged 23-45. The inclusion criteria were as follows: age below 50, nonbacterial nature of inflammation in the prostate (microbial count  $< 10^4$  CFU/ml), absence of symptoms of aggravation of the inflammatory process, and a total score on the erectile function questionnaire of  $< 20$ . The exclusion criteria were as follows: bacterial prostatitis and aggravation of the inflammatory process requiring administration of antibacterial drugs, bladder concretions, hematuria, level of prostatic specific antigen of  $> 2$  ng/ml, presence of general contraindications to physiotherapy. The patients of the main group were treated with physiotherapy complex including transrectal application of MAVIT® in monotherapy mode with 3 types of exposure: hyperthermia (constant temperature within 38.5 °C), pulsed magnetic field (frequency of 20-100 Hz and induction of 3-30 MT) and mechanical vibration (frequency of 20-100 Hz). The course of treatment included 10 sessions given every second day.

17 patients had mild erectile dysfunction (16-20 points) and 10 patients had moderate erectile dysfunction (11-15 points). Erectile dysfunction was characterized by a decrease in spontaneous and reflexogenic erections, weak orgasm, decreased libido, and premature ejaculation. According to the research data (ultrasound dopplerography of vessels of the penis prostate)



erectile dysfunction in all patients was a type of complication of chronic prostatitis and was associated with inflammatory and stagnant processes in the prostate and pelvic organs, subjective condition (pain, dysuric syndromes), psychoemotional state of patients, as well as with changes in the hormonal status.

The content of cytokines in the blood serum and pancreatic secretions was determined using sets of reagents from TOO Tsitokin (limited Liability Partnership)(Saint Petersburg, Russia). The cytokine concentration was measured by solid-phase enzyme immunoassay using double antibodies. The samples were analyzed using spectrometry at a wavelength of 450 nm [17].

The concentration of IL-1b, IL-6, IL-8, TNF-a and IFN-γ was determined using the proinflammatory cytokines in the pancreatic secret.

The hemodynamics in the prostate was studied using ultrasound doppler color flow mapping including assessment of the maximum systolic, diastolic and average linear blood flow velocity in the veins and vessels of the microcirculatory bloodstream, as well as blood flow in the prostate. The levels of follicle-stimulating and luteinizing hormones, prolactin, estradiol, total and free testosterone, and sex-steroid-binding globulin in the serum were determined using enzyme immunoassay. The indicators obtained in men from the control group were considered as normal values.

The patients were examined using the International Index of Erectile Function (IIEF) Questionnaire [18]. The scale for the quantitative evaluation of male copulative function (the MCF scale) was used [19]. The statistical analysis of the data obtained from the groups was performed using the Statistica 8.0 software package where the arithmetic mean (m) and the error of the arithmetic mean (t) were calculated. The indicators of the opposing groups were compared using the Student's t-Test. The differences between the groups were considered significant if the achieved level of statistical significance was  $p < 0.05$ .

### Results and Discussion

The most pronounced changes in the proinflammatory cytokine levels were observed in the pancreatic secret, while those in blood plasma were insignificant and statistically unreliable (Table 1). Thus, the concentration of IL-8 in the secretions of the prostate in patients with CNP who had already passed the acute phase was initially equal to  $53.0 \pm 2.0$  pg/ml (norm —  $36.0 \pm 0.8$  pg/ml), IL-6 —  $42.0 \pm 1.3$  pg/ml (norm —  $35.5 \pm 1.7$  pg/ml).

The changes in the levels of other proinflammatory cytokines (IL-1H, TNF-a and IFN-γ) were insignificant and statistically unreliable, but the levels tended to increase (see Table 1). After the course of treatment, all studied indicators approached normal values but after 3 months they increased again almost to the initial level, which indicates the need for a repeated course

**Table 1.** Changes in the Levels of Pro-Inflammatory Cytokines in Prostate Secretions and Blood Plasma in Patients with Chronic Nonbacterial Prostatitis under the Influence of Magnetic Vibration Heating Massage

Indicator	Value			
	Control group (n = 10)	Main group (n = 27)		
		before treatment	after treatment	3 months after treatment
IL-1b, pg/ml Prostate secretions Blood plasma	41.5 ± 2.0 39.4 ± 1.6	43.0 ± 1.8 40.0 ± 2.0	40.0 ± 1.7 38.7 ± 1.5	42.0 ± 1.4 42.6 ± 1.5
IL-6, pg / ml Prostate secretions Blood plasma	35.5 ± 1.7 49.0 ± 2.6	42.0 ± 1.3* 44.0 ± 2.3	34.6 ± 1.8* 41.3 ± 1.4	43.0 ± 1.6 43.4 ± 1.5
IL-8, pg / ml Prostate secretions Blood plasma	36.0 ± 0.8 70.0 ± 2.5	53.0 ± 2.0* 74.3 ± 3.2	35.4 ± 3.0* 72.6 ± 1.5	47.7 ± 1.5 71.5 ± 1.8
TNF-a, pg / ml Prostate secretions Blood plasma	40.0 ± 2.5 63.0 ± 1.4	43.4 ± 1.8 64.2 ± 1.8	41.0 ± 1.7 61.7 ± 2.0	42.6 ± 1.5 60.0 ± 1.2
IFN-γ, pg / ml Prostate secretions Blood plasma	42.0 ± 2.3 47.0 ± 1.8	44.3 ± 2.6 49.0 ± 1.5	41.8 ± 2.0 48.0 ± 1.3	43.0 ± 1.4 47.5 ± 1.6

Note. IL— Interleukin; TNF - Tumor necrosis factor; IFN-γ — Interferon gamma.

Comment for Tables 1-5: types of comparison — "before treatment" against the control group; "after treatment" against "before treatment"; "3 months after treatment" against "before treatment". \* $p < 0.05$ .

using cytokine antagonists.

After the magnetic vibration heating massage therapy, the main indicators of the prostate blood flow, initially decreased due to CNP, increased significantly and consistently. Thus, after the course of treatment the peak systolic, diastolic and average linear blood flow velocity, as well as the prostate blood flow approached the values of the control group, but after 3 months after the therapy these indicators returned to the initial level (Table 2).

It seems that the treatment reduces the level of pro-inflammatory cytokines in patients with CNP and thus improves microcirculation in the prostate, which must facilitate restoration of erectile function in these patients.

All patients had reliably reduced initial levels of total testosterone (by 25.0%) and free testosterone (by 30.4%) in comparison with the normal values (Table 3). After the course of treatment, almost all patients showed

a statistically reliable increase in total testosterone in the blood plasma (by 40.9 %), and in free testosterone (by 41.2%) (see Table 3). Compared with the initial values, the concentration of follicle-stimulating and luteinizing hormones, estradiol, and prolactin in the blood plasma decreased, yet the decrease was not statistically reliable. 3 months after the end of the course of treatment, all studied indicators returned to the initial level (see Table 3).

In the setting of the given therapy the erectile function improved by 75.0% compared to the initial values after the course of treatment; satisfaction of the patients with their sexual intercourse increased by 52.2%; orgasmic function — by 20.0%; libido — by 39.5%; sex life satisfaction — by 32.6% (Table 4).

The clinical and functional evaluation (in points) of the copulative cycle components in patients with CNP and erectile dysfunction before the course of magnetic vibration heating massage was characterized by increased neurohumoral component, which was 3 times higher than the normal values; the psychic, erection, and ejaculation components were

**Table 2.** Changes in the Prostate Gland Blood Flow Indicators in Patients with Chronic Nonbacterial Prostatitis under the Influence of Magnetic Vibration Heating Massage

Indicator	Value			
	Control group (n = 10)	Main group (n = 27)		
		before treatment	after treatment	3 months after treatment
Peak systolic velocity, cm/s	12.38 ± 0.91	9.10 ± 0.74*	13.4 ± 1.4*	10.0 ± 0.36
Diastolic velocity, cm/s	4.26 ± 0.46	3.00 ± 0.30*	4.35 ± 0.27*	3.10 ± 0.20
Average blood velocity, cm/s	7.96 ± 0.98	5.93 ± 0.56*	7.50 ± 0.85*	6.40 ± 0.38
Blood flow, l/min	0.03 ± 0.001	0.01 ± 0.006*	0.02 ± 0.001*	0.01 ± 0.003
Linear velocity of blood flow in veins, cm/s	4.98 ± 0.35	3.40 ± 0.30*	4.40 ± 0.56*	3.50 ± 0.91

**Table 3.** Changes in the Levels of Steroid Hormones in Patients with Chronic Nonbacterial Prostatitis accompanied by Erectile Dysfunction under the Influence of Magnetic Vibration Heating Massage

Indicator	Value			
	Control group (n = 10)	Main group (n = 27)		
		before treatment	after treatment	3 months after treatment
Prolactin, mIU/L	172.0 ± 12.0	203.15 ± 21.0	185.34 ± 17.30	201.36 ± 19.0
Total testosterone, nmol/l	14.0 ± 1.3	10.50 ± 0.42*	14.80 ± 0.46*	12.70 ± 0.36
Free testosterone, nmol/l	16.60 ± 1.34	11.60 ± 0.24*	15.30 ± 1.12*	13.40 ± 1.15
SHBG, nmol/L	34.72 ± 4.86	48.53 ± 4.26*	40.65 ± 3.27	39.41 ± 2.36
FSH, IU/ml	4.76 ± 0.30	5.24 ± 1.15	4.95 ± 0.75	5.34 ± 1.10
LH, IU/ml	5.30 ± 0.37	5.43 ± 0.70	5.37 ± 0.42	5.48 ± 0.83
Estradiol, pmol/L	64.2 ± 4.3	70.4 ± 4.0	69.3 ± 3.4	69.8 ± 5.3

*Note.* SHBG — Sex hormone-binding globulin; FSH — Follicle-stimulating hormone; LH — luteinizing hormone.



**Table 4.** Integral indicators on the International Index of Erectile Function Questionnaire in Patients with Chronic Nonbacterial Prostatitis accompanied by Erectile Dysfunction under the Influence of Magnetic Vibration Heating Massage (in points)

Indicator	Value			
	Control group (n = 10)	Main group (n = 27)		
		before treatment	after treatment	3 months after treatment
Erectile function	27.0 ± 0.4	16.0 ± 0.3*	28.0 ± 0.5*	17.5 ± 0.3
Satisfaction with sexual intercourse	14.04 ± 0.20	8.0 ± 1.2*	13.5 ± 0.4*	10.6 ± 0.8
Orgasmic function	10.0 ± 0.3	7.6 ± 0.3*	9.5 ± 0.6*	8.0 ± 0.4
Libido	9.3 ± 0.4	4.7 ± 0.5*	10.0 ± 0.2*	5.4 ± 0.3
Satisfaction with sex life	9.0 ± 0.2	3.0 ± 0.4*	8.5 ± 0.3*	3.2 ± 0.6

**Table 5.** Clinical and Functional Assessment of the Copulatory Cycle Components in Patients with Chronic Nonbacterial Prostatitis accompanied by Erectile Dysfunction under the Influence of Magnetic Vibration Heating Massage

Component	Score			
	Control group (n = 10)	Main group (n = 27)		
		before treatment	after treatment	3 months after treatment
Neurohumoral	4.5 ± 0.7	13.5 ± 1.5*	4.7 ± 0.8*	14.0 ± 0.5
Mental	3.4 ± 0.4	13.0 ± 1.1*	3.5 ± 0.7*	10.5 ± 1.2
Erectile	3.9 ± 0.3	17.5 ± 1.5*	4.2 ± 0.6*	15.8 ± 1.3
Ejaculatory	5.8 ± 0.4	15.5 ± 1.0*	6.0 ± 0.5*	13.7 ± 1.6

4, 4.5, and 3 times higher than the normal values, respectively. After the course of treatment the neurohumoral component decreased by 3 times; the psychic component — by 4 times; the erection component — by 4 times; and the ejaculatory component — by 2.5 times in comparison with the initial data, reaching almost normal values. 3 months after the course of treatment, all studied parameters were significantly close to the initial values (Table 5).

#### Conclusions

1. In patients with CNP the sluggish inflammatory process is supported by pro-inflammatory cytokines produced in the prostate.

2. The use of magnetic vibration heating massage of the prostate reduces the increased level of pro-inflammatory cytokines in this organ, improves microcirculation, increases the level of testosterone and stimulates the erectile function of patients. A repeated course of magnetic vibration heating massage should be performed 3 months after the 1st course.

3. The analysis of the patient examination data showed pathogenetic validity and high efficiency of the complex physiotherapy with MAVIT® when used as part of the combined treatment of patients with CNP accompanied by erectile dysfunction.



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