

Research Letter

THz therapy effects in patients of different age groups with angina

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Abstract: There had been studied the effect of THz therapy of nitrogen oxide (NO) waves in effort angina at 36 middle-aged patients and at 20 patients of a certain age. Antianginal effect in the both groups did not differ. At the middle-aged patients (46-59 years) there had been revealed an increase of anticoagulant blood potency, at the elderly patients (60-74 years) – a decrease of natural procoagulant activity.

Keywords: THz therapy, angina, age

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Introduction

Age sensitivity of patients with angina to different therapeutic methods, as drug as non-drug, is not enough studied. At the same time, the change of sensitivity to treatment depending on age, can cause an effectiveness or ineffectiveness of the treatment.

THz therapy is a new non-drug method of treatment which includes the usage of THz electromagnetic radiation (EMR) [1]. Today THz radiation of nitrogen oxide (NO) molecular spectrum (150.176...150.644 GHz) (THz-therapy-NO) is widely used in cardiology, its influence, probably, as we can see from the experiments [2], is realized by NO cycle modulation. Positive effect of EMR THz-NO on the patients with a cardiovascular pathology does not cause any doubts, as the set of experiments displayed a decrease of angina episodes, heart rate and arterial tension (systolic and diastolic) under the exposure of THz-therapy-NO, in the patients with stable and unstable angina, effect on hemostasis system and rheological blood properties [3, 4]. At this stage of the research we concentrate our attention on the detalization of THz waves effects, which can let perform an individual irradiation parameters in clinical practice. On the base of the given experiments there had been revealed that in high-sensitive patients a shorter radiation time-mode should be used [3], at chronic DIC syndrome – 7 sets instead of 10 is enough [5]. There had not been fixed differences in antianginal effect of THz waves in men and women with angina [6], but antihypertensive influence of EMR THz-NO is more evident in men.

The given study aimed to study age sensitivity to THz-therapy-NO in patients with effort angina of III-IV f.c.

Material and Methods

56 patients with effort angina of III-IV f.c. had been examined; they had been exposed by EMR THz-NO on the background of a general drug therapy (aspirin, β -adrenoblocker, nitrates and etc.). The patients had been divided into: the group of middle-aged persons (46-59 years) and the elderly patients (60-74 years) (according to WHO classification). The I group included 36 patients, the II group – 20 patients.

The groups were comparable at sex, diagnosis, severity of the initial state, myocardial infarction episode, arterial hypertension, blood circulation and rhythm defects and drug therapy.

EMR THz-NO exposure had been performed with the help of a portable generator. An intermittent irradiation time-mode «3/15» had been used (3-minute radiation, 21-minute pause, course duration – 21 minutes). The transmission delivers 500 μ W, irradiator had been located 4 cm above the metasternum, the power density was 17.4 μ W/cm². Irradiation course – 10 sets.

An antianginal treatment effect and dynamics of hemostasis system parameters had been estimated. An antianginal treatment effect was estimated in points according to a relative change of the numbers of angina episodes per day and daily nitroglycerin maintenance [3]. Clinical efficiency had been considered high (excellent) at a total elimination of angina episodes (3 points), well – at a decrease of throes and daily nitroglycerin maintenance to 75% and more from the initial level (2 points). At the decrease of anginal pain episodes and daily nitroglycerin maintenance in the range of 50-75% the effect was estimated as moderate (1 point). The absence of an antianginal effect was determined as 0 points, recrudescence – 1 point.

The research of procoagulative hemostasis system component included a determination of activated partial thromboplastin time (APTT, sec.), activated time of plasma recalcification (ATR, sec.), prothrombin time (PT, sec.) and fibrinogen (FG, g/l) concentration by consistent gravimetric method by R.A. Rutberg (1961). To estimate an anticoagulative hemostasis system potency antithrombin-III activity had been studied (At-III, %) with the use of kits by «Технология-Стандарт» by U. Abildgaard et.al. (1970). Fibrinolytic activity of plasma was estimated by XIIa-kallikrein-dependent euglobulin fibrinolysis (EF, min).

Results

In the group with the middle-aged patients there were people of 52.9 ± 0.8 years, in the group of elderly age – 65.5 ± 0.7 years ($p < 0.05$).

On the background of combined (drug and THz-therapy) there had been noted a statistically valid decrease of the numbers of angina episodes in both groups: in the I group – from 7.48 ± 1.71 to 0.56 ± 0.13 episodes per day before and after treatment ($p < 0.05$), in the II group – from 5.69 ± 0.63 to 0.25 ± 0.09 episodes per day ($p < 0.05$). At the dismissal from hospital the numbers of angina episodes in both groups did not differ ($p > 0.05$). So, there had not been revealed age differences in sensitivity to antianginal effect of THz waves.

Analyze of hemostasis system parameters shown that in different age groups there were differences in sensitivity of separate clotting components to EMR THz-NO.

The effect of THz waves on procoagulative potential was fixed only in the group of elderly patients (Table 1). An increase of ATR ($p < 0.05$) and decrease of fibrinogen concentration ($p < 0.05$) had been denoted till the end of the THz-therapy-NO course. The revealed change display that in this group of the patients there is a decrease of antithrombogenic potential of blood is caused by an effect as at first stages (ATR), as at final (fibrinogen) stages of clotting. Generally we can say that THz waves decrease an activity of natural procoagulants at elderly patients. There had not been noted statistically valid change in ATR and fibrinogen parameters in the group of the middle-aged patients till the end of the treatment course ($p > 0.05$) (Table 1). The dynamics of APTT had not been revealed in both groups (Table 1).

Table 1. The dynamics of hemocoagulation and fibrinolysis in the patients with angina in different age groups with the use of THz-therapy-NO (M \pm m)

Parameters	Follow-up period	Groups of persons with angina	
		Middle age (n=36)	Elderly age (n=29)
APTT	Before treatment	40.68 \pm 1.72	39.42 \pm 2.41
	After treatment	43.90 \pm 2.26	42.75 \pm 2.79
ATR	Before treatment	63.80 \pm 1.56	64.0 \pm 1.83
	After treatment	65.70 \pm 1.70	67.10 \pm 1.84 *
FG	Before treatment	3.60 \pm 0.10	3.73 \pm 0.13
	After treatment	3.60 \pm 0.12	3.40 \pm 0.14*
AT-III	Before treatment	77.07 \pm 6.30	67.10 \pm 13.30
	After treatment	93.85 \pm 4.17 *	78.60 \pm 9.49
EF	Before treatment	9.05 \pm 0.48	9.74 \pm 0.77
	After treatment	9.90 \pm 0.90	8.13 \pm 0.81

* – difference with “before treatment” parameter is statistically valid ($p < 0.05$).

Discussion

In the presented study there had been denoted that THz-therapy has a positive effect on clinical progression and hemocoagulative parameters in the patients with effort angina of III-IV f.c. of different age.

At the same time there were the results that displayed a relatively independent dynamics of parameters of hemocoagulative parameters and antianginal effect of THz-therapy-NO in the examined patients. A rapid relief of angina symptoms had been progressing equally in the middle-aged and elderly patients, and change in parameters of thrombogenic blood potency was significantly different.

In the middle-aged patients normalization of hemocoagulative parameters was caused by an increase of antithrombin-III activity up to its total recovery, there was not fixed an effect on procoagulative potential. In the group of elderly patients the THz-therapy-NO effect was realized by a positive dynamics of natural procoagulants level, the exposure was as at first stages, as at final stages of clotting, which was evident from fibrinogen decrease in combination with prolonged ATR. There was not dynamics of antithrombin-III activity. Parameters of fibrinolysis activity did not differ under the THz-therapy-NO neither in the group I, nor in the group II.

An antianginal effect of EMR of THz-NO is the same in groups of the middle-aged and elderly patients with angina, the effect on a hemostasis system differs significantly. It is not possible to explain this positive clinical dynamics only by a normalization of hemocoagulation.

Taking into account a possible mechanism of THz waves' effect through the modulation of NO cycle [2], it appears that the variety of effect of THz-therapy-NO on hemostasis system parameters in the patients of the studied age groups can be connected with age-related changes of some NO cycle components or NO-synthase activity.

In this case an integral index of EMR of THz-NO effect – antianginal effect – can be realized through various mechanisms of microcirculation improvement and decrease of thrombogenic blood potency. The final result - rapid relief of angina symptoms – is achieved by activating of different adaptation mechanisms, but is comparable independent from age.

Conclusion

1. THz-therapy of NO band has a positive effect on a clinical state and parameters of hemocoagulation of the middle-aged and elderly patients with angina.
2. An antianginal effect of THz-therapy-NO is evident in the patients with effort angina of III-IV f.c. independent from age.
3. Effect of THz waves on hemostasis system state in the middle-aged patients is realized through the activation of anticoagulative blood potential up to its total recovery.
4. An improvement of hemocoagulation indices under the THz-therapy-NO in the patients of elderly age is realized through a decrease of procoagulants level.

Conflict of interest: none declared.

Reference

1. Betsky OV, Krenitsky AP, Maiborodin AV. Biophysical effects of THz-band and perspectives of progress in a new direction in biomedical

- technologies. *Biomedical Radioelectronics* 2003; (12): 3-6. [Article in Russian]
2. Kirichuk VF, Ivanov AN, Kulapina EG, Krenickiy AP, Mayborodin AV. Effect of Terahertz Electromagnetic Irradiation at Nitric Oxide Frequencies on Concentration of Nitrites in Blood Serum of Albino Rats under Conditions of Immobilization Stress. *Bull Exp Biol Med* 2011; 149(2): 174-176. (PMID: 21113484) (doi: 10.1007/s10517-010-0900-9)
 3. Parshina SS. Clinical features of the use of THz-therapy-NO in the patients with angina. *Biomedical Radioelectronics* 2006; (1-2): 4-11. [Article in Russian]
 4. Parshina SS, Kirichuk VF, Golovacheva TV, Afanasyeva TN, Tupikin VD, Krenitsky AP, Mayborodin AV, Lopatina NA. Electro-magnetic radiation of terahertz range, NO molecular specter frequencies, and coagulation hemostasis in patients with various angina forms. *Cardiovascular Therapy and Prevention* 2006; (4): 70-74. [Article in Russian]
 5. Vodolagin AV. Features of DIC syndrome in patients with effort angina of high functional classes and optimizing of the treatment. Abstract of PhD dissertation, Saratov, 2008. [Text in Russian]
 6. Parshina SS, Golovacheva TV, Afanasjeva TN, Glukchova NA, Potapova MV, Grizenger VR, et.al. Particularities of the hemodynamic effects of the terahertz therapy in patients with angina pectoris of both sexes. *Biomedical Radioelectronics* 2011; (8): 58-63. [Article in Russian]

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