

Alypova E.E. Vasomotor endothelial function and microcirculation in elderly patients with isolated systolic arterial hypertension: influence of "dry" carbonic baths and general low-frequency magnetotherapy. *Journal of Health Sciences*. 2013;3(11):203-210.

The journal has had 5 points in Ministry of Science and Higher Education of Poland parametric evaluation.
Part B item 1107. (17.12.2013).

© The Author (s) 2013;
Conflict of interest: None declared. Received: 15.10.2013. Revised: 24.12.2013. Accepted: 29.12.2013.

This article is published with open access at Licensee Open Journal Systems of Radom University in Radom, Poland
Open Access. This article is distributed under the terms of the Creative Commons Attribution Noncommercial License which permits any noncommercial use, distribution, and reproduction in any medium, provided the original author(s) and source are credited. This is an open access article licensed under the terms of the Creative Commons Attribution Non Commercial License (<http://creativecommons.org/licenses/by-nc/3.0/>) which permits unrestricted, non commercial use, distribution and reproduction in any medium, provided the work is properly cited.

616.12-008.333.1-053.86/.89-085]:615.83 – 036.8

VASOMOTOR ENDOTHELIAL FUNCTION AND MICROCIRCULATION IN ELDERLY PATIENTS WITH ISOLATED SYSTOLIC ARTERIAL HYPERTENSION: INFLUENCE OF "DRY" CARBONIC BATHS AND GENERAL LOW-FREQUENCY MAGNETOTHERAPY

E.E. Alypova

State Institution “Zaporizhia Medical Academy of Post-Graduate
Education Ministry of Health of Ukraine”

Key words: arterial hypertension, isolated systolic arterial hypertension, elderly patients, rehabilitation, microcirculation, vasomotor endothelial function, general low-frequency magnetotherapy, "dry" carbonic baths.

Abstract. The comparative estimation of influence of the general low-frequency magnetotherapy (GLMT) and "dry" carbonic baths (DCB) on indicators of vasomotor endothelial function and microcirculation in elderly patients with isolated systolic (ISAH) arterial hypertension has been studied. The efficiency of application the combined use of the GLMT and "dry" carbonic baths DCB for correction of revealed disorders in comparing to the monovariant use of thees medical physical factors is established.

Introduction. Prevalence of the arterial hypertension (AH) steadily increases with age, reaching the level of 75,4% in persons over 65 years [7, 8, 10] with an overrepresentation of special clynic-pathogenetic variant: isolated systolic AH (ISAH) [7, 8, 11] and existence of the morphofunctional changes, being characterized by the evident abnormality of the endothelial function (EF) [2, 5-8, 10] and microcirculation (MC) [3, 9].

Non-drug methods of treatment and prevention, including therapeutic physical factors (TPF) are extensively administered to correction of the specified abnormality in the last decades [1, 3, 10].

Research on studying of influence of the complex physiotherapy including "dry" carbonic baths (DCB) and the general low-frequency magnetotherapy (GLMT) on vasomotor EF and MC in elderly patients with ISAH wasn't carried out.

Thus, **the aim** of present research is comparative estimation of influence of the GLMT and DCB on indicators of vasomotor EF and MC in elderly patients with ISAH.

Materials and methods. In the conditions of clinical sanatorium 180 patients (96 men and 84 women aged from 60 till 74 years (middle age of $65,8 \pm 6,2$ years) with ISAH are examined. ISAH (grade 1 and 2) – definition by ESH/ESC, 2013 [11]. The average duration of ISAH was $12,9 \pm 5,7$ years.

Depending on used TPF patients was divided into groups: group A is control (n=30) – drug therapy with simulated placebo of physiotherapy; group B (n=50) is DCB administration; a group C is GLMT administration; group D (n=50) is a combined administration of DCB and GLMT.

Dynamic complex clinical and laboratory trial was lead before and after a 21-day course of recovery treatment. Patients of both groups received the equivalent basic rehabilitation complex on the basis of modern standards drug [11] and rehabilitation [4] of AH.

DCB was carried out in a special device by the following technique: concentration of carbon dioxide is 12,8 vol.%; speed flow is 15 l/min, temperature of a gas mixture is 28°C, 10 procedures per 15 min. in a day.

GLMT was conducted by means of the device "DIMAP D2000" (Czech Republic) by a technique of general influence (on back area) is the magnetotherapeutic applicator – mattress; a pulsed magnet field with low frequencies (72 Hz) was applied, with the maximum intensity 3 mT; 10 procedures per 25 min in a day.

The assessment of condition of MC was studied by a Laser doppler flowmetria (LDF) method with the use of the laser analyzer of transcapillary flow is LATF-02 (SMG "LAZMA", Russia). Parameters were estimated [1]: indicator of MC (IM), coefficient of variation (CV), amplitude-frequency range of LDF-grams: amplitude of low (ALF), high (AHF), cardial (ACF) fluctuations (perf. units); indicator of efficiency of MC (IEM), rel. unit.

Vasomotor EF was estimated by means of humeral artery Doppler ultrasonography (the device Esaote "MyLab" (Italy)) the linear probe of 7,5 MHz by D.S. Celermajer technique [5] in test with a reactive hyperemia and definition of indicators of endothelium-dependent (EDVD) and endothelium-independent (EDID) of vasodilation.

Statistical processing of results was carried out with use of Student's t-criterion, the correlation analysis. Statistically significant one considered distinctions at $p < 0,05$.

Results and discussion. Results of probe of indicators of vasomotor EF in elderly patients with ISAH are presented in table 1.

Is established that normal EDVD (more than 10%) in test with a reactive hyperemia took place in 34,3% of cases; in 43,3% of patients the insufficient dilated response (a gain of diameter of a humeral artery in the range from 0% to 9,9%) was revealed.

In 15 patients (8,3%) paradoxical reaction an endothelia with a vasoconstriction (EDVD less than 0%) was observed.

Monovariant administration of DCB in elderly patients with ISAH led to accuracy increase in indicators of EDVD (by 20,8%, $p < 0,01$) and EIVD (by 13,6%, $p < 0,05$) whereas the usage of GLMT didn't lead to essential changes of EDVD and EIVD which increase was (5,1% and 5,7%, $p > 0,05$) accordingly.

At combined use of GLMT and DCB in patients with ISAH the increase of EDVD by 48,1% ($p < 0,001$) and EIVD by 30,2% ($p < 0,001$) was noted at parallel correction of structure of reactions to test with a reactive hyperemia: more than twice (from 42,9% to 88,4%) increased the number of patients with normal

response, the vasospastic type of reaction disappeared. In control group similar dynamics wasn't revealed.

Table 1

Dynamics of indicators of endothelial function against course administration of "dry"

Indicator, unit of measure		EDVD, %	EIVD, %
Group A control (n = 30)	Before treatment	5,49 ± 0,68	15,21 ± 0,68
	After treatment	5,62 ± 0,71 ^Z	15,46 ± 0,35
Group B DCB (n = 50)	Before treatment	6,55 ± 0,42	17,12 ± 0,69
	After treatment	7,91 ± 0,96*#	19,46 ± 0,35*#
Group C GLMT (n = 50)	Before treatment	7,19 ± 0,76	16,91 ± 0,69
	After treatment	7,43 ± 0,68#	17,22 ± 0,35#
Group D DCB+ GLMT (n = 50)	Before treatment	7,13 ± 0,94	17,71 ± 1,28
	After treatment	10,56 ± 0,42***#	23,05 ± 0,35***#

carbonic baths and the general low-frequency magnetotherapy in patients with ISAH (M ± SD)

Notes: * - p <0,05; ** p <0,01 is accuracy of disparity with initial level; # – p <0,05 is accuracy of disparity in comparison with control; ^Z is tendency in disparity with an initial indicator.

While studying MC at elderly patients with ISAH at initial level significant distinctions of microhemodynamics levels of indicators of IM, ALF, IEM between groups wasn't founded.

For specification of the role of vasomotor EF in elderly patients with ISAH we carried out the correlation analysis of size EDVD with the MC parameters. Direct dependence of EDVD with IM (r=+0,63; p<0,01), ALF (r=+0,41; p<0,01 (r =+0,63), IEM (r=+0,39; p<0,01) and inverse is with ACF (r=- 0,56; p<0,02) and AHF (r=-0,54; p<0,01) is revealed.

In patients with ISAH it was succeeded to reach accuracy positive dynamics of an indicator of IM at monovariant administration of DCB which made 3,44±0,58 perf. units to and 4,15±0,61 perf. units (p<0,05) is after course treatment. Concerning indicators of ALF and IEM accuracy positive changes wasn't revealed.

At monovariant use of GLMT in patients with ISAH in group C had no statistically significant disparity of AHF before and after treatment which made $0,22 \pm 0,09$ perf. units and $0,20 \pm 0,10$ perf. units ($p > 0,05$) that reflects the lack of positive influence of GLMT on a condition of venous microhemodynamics.

It is established that the most significant positive changes are reached in patients with ISAH in group D at combined use of DCB and GLMT that is presented in the table 2.

So, after DCB treatment in a complex with GLMT the accuracy increase in amplitude of ALF fluctuations was occurred on the average by 68,4% ($p < 0,001$), whereas in control group of the dynamics of this indicator do not exceed 4,4% ($p = 0,366$).

Table 2

Dynamics of indicators of microcirculation against the course combined administration of "dry" carbonic baths and the general low-frequency magnetotherapy in patients with ISAH
(M \pm SD)

Group/ Indicator, unit of measure	Control group A (n = 30)	p	Group D DCB+GLMT (n = 50)	p	Before treatment pA-D	After treatment pA-D
IM, perf. unit.	$\frac{3,46 \pm 0,68}{3,69 \pm 0,85}$	0,366	$\frac{3,52 \pm 0,87}{4,89 \pm 0,72}$	0,034	0,834	0,044
CV, %.	$\frac{12,15 \pm 2,42}{11,06 \pm 1,92}$	0,115	$\frac{13,25 \pm 2,03}{10,92 \pm 1,64}$	0,042	0,816	0,911
ALF, perf. unit	$\frac{0,90 \pm 0,23}{0,94 \pm 0,51}$	0,366	$\frac{0,92 \pm 0,23}{1,55 \pm 0,51}$	$p < 0,001$	0,682	0,038
AHF, perf. unit	$\frac{0,59 \pm 0,94}{0,52 \pm 0,41}$	0,233	$\frac{0,63 \pm 0,94}{0,39 \pm 0,42}$	$p < 0,001$	0,711	0,008
ACF, perf. unit	$\frac{0,37 \pm 0,94}{0,35 \pm 0,42}$	0,286	$\frac{0,31 \pm 0,34}{0,19 \pm 0,45}$	0,008	0,334	0,007
IEM, rel. unit	$\frac{1,59 \pm 0,28}{1,64 \pm 0,42}$	0,316	$\frac{1,67 \pm 0,28}{2,39 \pm 0,42}$	$p < 0,001$	0,743	0,006

Notes: in numerator there are values before treatment, in denominator there are values after treatment; p – is significance value of distinctions before treatment; pA-D – is a significance value of distinctions between groups.

Along with increase of ALF in patients group D against the treatment accuracy decrease of AHF by 38,0% ($p < 0,001$), and ACF by 38,7% ($p < 0,001$) in the absence of accuracy changes was observed from the specified indicators in control group made accordingly 5,0% ($p = 0,233$) and 5,4% ($p = 0,286$).

The above-named shifts in addition illustrate IEM dynamics during treatment which reflects considerable redistribution of amplitude-frequency characteristics in the form of increase of active mechanisms of regulation of blood flow (ALF) and decrease of passive (AHF and ACF).

Such changes caused essential increase of IEM by 43,1% in patients with ISAH ($p < 0,001$) in group D in comparison with control group A (increase in IEM by 3,1% ($p = 0,316$)).

By this means, the received results of probe testify to more significant morpho-functional structural restructuring of microvessels in elderly patients with ISAH, the endothelial function which was accompanied by parallel violation is an endothelium-dependent and endothelium-independent of vasodilation coordinated with A.Virdis' data [9].

Administration of DCB and GLMT renders positive unidirectional effect on a condition of microcirculation and endothelial function in elderly patients' recovery treatment with ISAH.

Conclusion:

1. In elderly patients with ISAH the greatest corrective synergistic influence on system of microcirculation and endothelial function and SDAH render complex physiotherapeutic techniques with the combined administration of DCB and GLMT in comparison with monovariant use of TPF.

3. The combined administration of "dry" carbonic baths in a complex with the general low-frequency magnetotherapy in elderly patients with ISAH leads to decrease of a tone of a resistive link of MC of the course against balance of mechanisms of an autoregulation of a microbloodflow with prevalence of active modulators and eliminates the dysfunctional abnormality being accompanied with violation of an endothelium-dependent vasodilation.

References:

1. Лазерная доплеровская флоуметрия в оценке состояния и расстройств микроциркуляции крови: Метод. пособие для врачей/ Козлов В.И., Азизов Г.А., Гурова О.А. [и др.]. – Moscow, 2012. – 33р.
2. Andrawes W.F. Prevention of cardiovascular events in elderly people /W.F.Andrawes, C.Bussy, J.Belmin// Drugs Aging. – 2005. – Vol.22, №10. – P.859-876.
3. Arteriolar circulation and arterial pressure in patients with essential hypertension/V.S.Volkov [et al.] // Klin. Med. – 2010. – Vol.88,№6. – P.24-26.
4. Cardiovascular prevention and rehabilitation / J.Perk, P.Mathes, H.Gohlke [et al.]. – London: Springer-Verlag London Limited, 2007. – 440p.
5. Celermajer D.S. Non-invasive detection of endothelial dysfunction in children and adults at risk of atherosclerosis / D.S.Celermajer, K.E.Sorensen, V.M.Gooch // Lancet. – 1992. –Vol.340. – P.1111-1116.
6. Endothelial dysfunction and the risk of hypertension: the multi-ethnic study of atherosclerosis / D.Shimbo, P.Muntner, D.Mann [et al.] // Hypertension. – 2010. – Vol.55, №5. – P.1210-1216.
7. Gordon S.S. Management of hypertension in the elderly patient / S.S.Gordon // Clinical Interventions in Aging. – 2009. – Vol.9. – P.379-390.
8. Predictors of new-onset diastolic and systolic hypertension. The Framingham Heart Study/ S.S.Franklin, J.R.Pio, N.D.Wong [et al.] // Circulation. – 2005. – Vol.111. – P.1121-1127.
9. Viridis A. How to evaluate microvascular organ damage in hypertension: assessment of endothelial function / A.Viridis, S.Taddei // High. Blood. Press. Cardiovasc. Prev. – 2011. – Vol.18, №4. – P.163-167.
10. Yazdanyar A. The Burden of Cardiovascular Disease in the Elderly: Morbidity, Mortality, and Costs / A.Yazdanyar, A.B.Newman // Clin. Geriatr. Med. – 2009. – Vol.25, №4. – P.563-585.

11.2013 ESH/ESC guidelines for the management of arterial hypertension / G.Mancia, R.Fagard, K.Narkiewicz [et al.]// J. of Hypertension. – 2013. – Vol.31,№7. – P.1281-1357.

Credits (Author's data): Alypova E.E. is the candidate degree in Medical Sciences, associate professor of department of therapy, physiotherapy and profpathology, State Institution "Zaporizhia Medical Academy of Post-Graduate Education Ministry of Health of Ukraine" (SI "Zaporizhia Medical Academy of Post-Graduate Education Ministry of Health of Ukraine",

Vintera boulevard 20, Zaporizhia, 69096, Ukraine adminzmapo@gmail.com, elena_alyp@mail.ru, <http://www.zmapo.edu.ua> tel/fax +38061 279-01-92, 279-17-46, 279-16-38.

Сведения об авторах:

Алыпova Елена Евгеньевна – к.мед.н., доцент кафедры терапии, физиотерапии, курортологии и профпатологии ГУ «Запорожская медицинская академия последипломного образования МЗ Украины»
Адрес для переписки: Алыпova Е.Е. Украина, г. Запорожье, ул. 40 лет Советской Украины, д.78, кв.32. 69035., e-mail: elena_alyp@mail.ru

ВАЗОМОТОРНАЯ ФУНКЦИЯ ЭНДОТЕЛИЯ И МИКРОЦИРКУЛЯЦИЯ У БОЛЬНЫХ ПОЖИЛОГО ВОЗРАСТА С ИЗОЛИРОВАННОЙ СИСТОЛИЧЕСКОЙ АРТЕРИАЛЬНОЙ ГИПЕРТЕНЗИЕЙ: ВЛИЯНИЕ «СУХИХ» УГЛЕКИСЛЫХ ВАНН И ОБЩЕЙ НИЗКОЧАСТОТНОЙ МАГНИТОТЕРАПИИ

Е.Е.Алыпova

Государственное учреждение «Запорожская медицинская академия последипломного образования Министерства Здравоохранения Украины»

Ключевые слова: артериальная гипертензия, изолированная систолическая артериальная гипертензия, пожилой возраст, реабилитация, вазомоторная функция эндотелия, микроциркуляция. «сухие» углекислые ванны, общая низкочастотная магнитотерапия,

Резюме. Проведена сравнительная оценка влияния «сухих» углекислых ванн и общей низкочастотной магнитотерапии на показатели вазомоторной функции эндотелия и микроциркуляции у больных пожилого возраста с изолированной систолической артериальной гипертензией. Показана преимущественная эффективность комбинированного применения «сухих» углекислых ванн и общей низкочастотной магнитотерапии в коррекции выявленных расстройств вазомоторной функции эндотелия и микроциркуляции в сравнении с моновариантным применением данных лечебных физических факторов.