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WPŁYW ZAJĘĆ LECZNICZEGO WYCHOWANIA FIZYCZNEGO NA WSKAŹNIKI HEMODYNAMICZNE OSÓB WIEKU STARSZEGO

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Streszczenie. Obecnie wzrasta liczba osób starszych i bardzo starych na całym świecie. Analiza danych statystycznych sugeruje, że wraz z wiekiem wzrasta ciśnienie krwi. Wysokie ciśnienie skurczowe tętnic powoduje rozwój zawału mięśnia sercowego, choroby wieńcowej, udaru, a nawet śmierci. Dlatego celem było zbadanie wpływu fizykoterapii na stan układu sercowo-naczyniowego osób starszych na etapie szpitalnym. W badaniu wzięło udział 27 kobiet i 20 mężczyzn w wieku od 69 do 85 lat. Pacjenci w obu grupach mają prawdopodobne zmniejszenie częstości akcji serca i średnich wartości współczynnika sprawności układu krążenia (tylko kobiety). Zaproponowane przez nas klasy wychowania fizycznego przyczyniają się do możliwego zmniejszenia średnich wartości ciśnienia skurczowego i rozkurczowego tętnic, średniego ciśnienia krwi oraz możliwej poprawy średnich wartości objętości skurczowej i minutowej krwi.

Słowa kluczowe: układ sercowo-naczyniowy, ciśnienie tętnicze, osoby starsze.

INFLUENCE OF TREATMENTAL PHYSICAL CULTURE ON HEMODYNAMIC INDICATORS OF ELDERLY PERSONS

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Abstract. Nowadays, the number of elderly people is increasing throughout the world. Analysis of statistical data shows that blood pressure increases with the age. High arterial systolic pressure is the cause of the development of myocardial infarction, coronary heart disease, stroke and even death. Thus, the purpose was to study the influence of medical physical therapy to the state of the cardiovascular system of the elderly people at the hospital stage. 27 women and 20 men aged from 69 to 85 years old were investigated. The probable decrease in the average values of heart rate and coefficient of efficiency of the blood circulation system are recorded in patients of both groups. The classes of medical physical therapy offered by us contribute to a probable decrease in the average values of arterial systolic and diastolic pressure, medium arterial pressure, and a probable improvement in the average values of systolic and minute blood volumes.

Key words: cardiovascular system, blood pressure, heart rate, elderly persons.

ВПЛИВ ЗАНЯТЬ ЛІКУВАЛЬНОЮ ФІЗИЧНОЮ КУЛЬТУРОЮ НА ПОКАЗНИКИ ГЕМОДИНАМІКИ ОСІБ ПОХИЛОГО ВІКУ

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Анотація. На сьогодні в усьому світі спостерігається збільшення кількості людей похилого та старечого віку. Аналіз статистичних даних свідчить про те, що з віком артеріальний тиск підвищується. Високий артеріальний систолічний тиск спричиняє розвиток інфаркту міокарда, ішемічної хвороби серця, інсульту і, навіть, смерть. Тому мета полягала у дослідженні впливу лікувальної фізичної культури на стан серцево-судинної системи людей похилого віку на лікарняному етапі. У дослідженні брали участь 27 жінок і 20 чоловіків у віці від 69 до 85 років. У пацієнтів обох груп зареєстровано вірогідне зниження частоти серцевих скорочень і середніх значень коефіцієнту економічності системи кровообігу (лише у жінок). Запропоновані нами заняття лікувальної фізичної культури сприяють вірогідному зменшенню середніх значень артеріального систолічного та діастолічного тиску, середнього артеріального тиску, вірогідному покращенню середніх значень систолічного та хвилинного об'єму крові.

Ключові слова: серцево-судинна система, артеріальний тиск, особи похилого віку.

Formulation of the problem. Today, according to statistics, in all economically developed countries, the number of elderly and elderly people has almost doubled (Metody analiza i vozrastnye ..., 2003; Moreva D.U., Stadnuk L.A., Prihodko V.U., 2016). Thus, according to the estimation of the State Statistics Service of Ukraine in 2017, among the entire population of our country, about 16% are elderly and senile people (according to data - 2 409 049 men and 4 770 461 women) (Naselennâ Ukraïni na 1 sìcna, pocinauci z 1990 roku ...; Ukraine [The World Factbook ..., 2017]. Experts' forecasts suggest that by 2050, in Ukraine, persons over the working age will make up almost 38% (Naselennâ Ukraïni na 1 sìčnâ, počinaûči z 1990 roku ...; Ukraine [The. World. Factbook ..., 2017).

The analysis of statistical data shows that today the average life expectancy of men in Ukraine is about 67 years, and women are 77 years old (Ŝirina M.G., 2010; Ukraine [The. World. Factbook ..., 2017). It should be noted that in the countries of Eastern and Western Europe the life expectancy of the population is on average 9-10 years.

According to data from literary sources (Furman Û., Sulyma A., 2015; Sulyma A., Tkachenko T., 2018; Zabolevaniâ serdca i reabilitaciâ ..., 2000) with age there is a violation of biological rhythms of various systems of the organism, including cardiovascular diseases, vascular system. At the same time, circulatory system diseases are responsible for more than half of all deaths. According to statistics, over the past year alone, more than 300,000 deaths from cardiovascular diseases have been registered in our country (Naselennâ Ukraïni na 1 sìčnâ, počinaûči z 1990 roku ...; Ukraine [The. World Factbook ..., 2017].

Consequently, the above suggests that the study of the regularities of changes in the blood circulation system in the process of aging is important and relevant.

The state of scientific research. Analysis of statistical data in 2017 shows that in our country, almost 40% of people over the age of 60 have elevated arterial systolic and diastolic pressure (Ševčuk V.G., 2000; Zabolevaniâ serdca i reabilitaciâ ..., 2000). However, only 12% of patients with cardiovascular diseases are under constant medical supervision and one third of all patients receive effective and adequate treatment.

The results of experimental studies of many authors (Dzâk VG, Drynovec VI, Vasil'eva LI, Hanûkov AA, 1999; Metody analiza i vozrastnye ..., 2003; Ŝirina MG, 2010) indicate that almost 25% of people over 65 have an arterial pressure of 160 / 100 mm Hg Art., and 53% - 150/90 mm Hg. st ..

Based on the analysis of the data of scientific literature (Furman Û., Sulyma A., 2015; Metody analiza i vozrastnye ..., 2003; Ŝirina M.G., 2010) it was established that with age, arterial pressure rises. So, in literary sources (Čebotarev DD, Korkusko OV, 2008; Sulyma A., Tkachenko M., 2018; Vitomskiy V., Hruzevych I., Salnykova S. et al., 2018), we find information that an increase in systolic and diastolic pressure is up to 60 years old. In the future, diastolic pressure does not change with age. On the contrary, systolic pressure continues to increase for women under 80 and for men up to 70 years old (Čebotarev DD, Korkusko OV, 2008; Morêva D.Û., Stadnûk LA, Prihod'ko V.Y., 2016; Sulyma A., Tkachenko M. ., 2018). Such age dynamics of changes in blood pressure contributes to the prevalence of so-called "isolated systolic hypertension". According to the results of randomized studies of SHEP and Syst-Eur, isolated systolic hypertension is observed in almost 6% of people aged 60-69, in 8% of 70-79 years of age and in 18-25% of people aged 80 years.

Clinical and statistical data indicate that high arterial systolic blood pressure is the cause of myocardial infarction, coronary heart disease, stroke, and mortality.

Treatment of patients with cardiovascular diseases is carried out by the complex application of various medical devices, among which physical rehabilitation facilities deserve special attention.

Thus, the purpose of the study was to investigate the effect of therapeutic physical culture on the state of the cardiovascular system of the elderly at the hospital stage.

To achieve the goal we solved the **following tasks:**

1. On the basis of the analysis of scientific and methodological literature, to reveal the features of the cardiovascular system in the elderly, as well as to explore the possibilities for improving the state of this system by applying therapeutic physical culture and massage.

2. To investigate the effectiveness of the influence of training physical education on the state of the cardiovascular system of patients 69-85 years at the hospital stage.

Methods and contingent of research. During the research, we used the following methods: theoretical analysis and generalization of literary sources; pedagogical observation; pedagogical experiment; pedagogical testing using methods of pulsometry, sphygmomanometry; methods of mathematical statistics.

The frequency of heart rate was determined palpated. The magnitude of arterial systolic and diastolic pressure was measured with the help of a sifigmomanometer "LD-81" in rest.

Pulse pressure (PT), which reflects the state of vessels, namely, their permeability and elasticity, as well as the functioning of the myocardium, were calculated as the difference between systolic and diastolic pressure.

In addition to systolic and diastolic blood pressure in medical practice, there is also mean arterial pressure (AT blood), which in clinical practice is called the pressure of the entire cardiac cycle. This pressure was calculated by the formula:

АТсер= АТдіаст+1/3·ПТ,

where AT diast - arterial diastolic pressure, millimeters of the mercury column

PT - pulse pressure, millimeters of the mercury column

Sufficiently common indicator, which is determined by the calculation method, is the coefficient of cost-effectiveness of the blood circulation system (KEK, cu). The value of this indicator was determined as the product of the frequency of heart rate and pulse blood pressure.

The systolic volume of blood is the volume of blood that moves from the heart to the blood vessels for one systole (Aronov D.M., Bubnova M.G., Pogosova G.V., 2006; Bogdanovs'ka N.V., Kal'onova V.V., 2012).

During the study, we calculated the systolic blood volume (SOC) using the formula Malikov MV, Bogdanovskaya N.V. (Bogdanovs'ka N.V., Kal'onova V.V., 2012):

СОК = 0,53 • ATsist + 0,617 • DT +0,231 • MT – 1,07 • ATdiast – 0,698 • B – 22,64,

where ATsist - arterial systolic pressure, mm Hg;

DT - body length, cm;

MT - body weight, kg;

ATdiast - arterial diastolic pressure, mm Hg;

B - age, years;

22.64; 1.07; 0.698; 0.617; 0.53 and 0.231 are the coefficients of the multiple regression equation.

A minute volume of blood, which shows the amount of blood transmitted by the heart for 1 min in a large or small circle of blood, was determined as a product of systolic blood volume and heart rate.

The minute volume of blood increases with chas muscle activity, after eating, as well as intravenous fluid injection and decreases in blood loss.

The probability of the difference between the mean values was determined by the t-criterion of Student. Reliability was considered significant at 5% level of significance $p < 0,05$.

Our research was conducted on the basis of the Vinnytsia Regional Clinical Hospital Veterans of the War. We studied 27 women and 20 men aged 69 to 85 years. All the patients were on inpatient treatment.

All subjects were divided into 2 groups: control group (CH), which numbered 23 persons (including 13 women and 10 men), and the main (CO) - 24 persons (14 women and 10 men). The patients of the KG were engaged in the program of the medical institution, and the patients of the OG additionally visited the classes we developed by the medical physical education.

The content of physical education classes included various exercises for muscle relaxation and general developmental exercises that stimulate extracardiac factors in hemodynamics and improve blood flow in the vessels of the brain. Includes also respiratory exercises with respiratory depression on exhalation, which affect the receptors of the vagus nerve, which leads to a decrease in blood pressure, a decrease in peripheral resistance to blood flow and a slowdown in the heart rate.

Duration of studies at the beginning of the study lasted 25-60 minutes, and later - 75-90 minutes. Moreover, the duration of the session depended on the intensity, that is, the less intensity, the greater the duration. Frequency of classes with therapeutic physical cultures 3 times a week.

Many specialists (Bogdanovs'ka NV, Kal'onova V.V., 2012; Korol'chuk AP, Sulyma AS, 2018; Širina MG, 2010) have proved that the mass influences positively on the changes of the indicators of central hemodynamics, in particular, contributes to the expansion of peripheral vessels, the facilitation of work of the left atrium and the left ventricle, to increase the myocardial ejection fraction. That is why all patients also visited massage, in particular, back massage, collar zone, and massages of the heart.

It is well-known that the adequacy of physical exercises in an age group is estimated by the heart rate after the termination of physical activity. To do this, we used the formula for determining the optimal heart rate:

170 - Age of person (years)

The formative study lasted for 21 days during the course of a flat course of treatment in a hospital on the basis of the Vinnytsia Regional Clinical Hospital of the Veterans of the War. An analysis of the functional state of the circulatory system of the elderly was carried out before and after physical rehabilitation.

Results of the research and their discussion. Prior to conducting a molding study, no statistically significant differences were recorded between the hemodynamics of the control and the main groups (p> 0.05).

As can be seen from Table 1, during the 21st day of treatment in the hospital, patients with both control and the main group registered probable changes in arterial systolic blood pressure.

Table 1

Hemodynamic indices of persons 69-85 years of control (n = 23) and main (n = 24) groups

Indexes		Average value, $\bar{x} \pm m$	
		at the beginning of the study	at the end of the study
AT syst. mm hg Art.	KG	155,65±1,66	150,9±1,10*
	OG	159,6±1,61	149,6±1,61*
AT dist., mm hg Art.	KG	107±1,65	103±1,65*
	OG	112,9±1,61	104±1,08*
AT mid., mm hg Art.	KG	122,9±2,57	119,28±0,92
	OG	128,5±1,96	119±1,08*
PT, mm hg Art..	KG	49,13±1,10	47,9±1,10
	OG	46,67±1,08	45,8±1,08*
ЧСС, уд/хв	KG	85,78±0,66	83,9±0,61*
	OG	84,38±0,86	80,8±0,91*

*Note: * - the differences with regard to the output data are statistically significant (p <0,05)*

Thus, the average value of the aforementioned indicator in CH patients probably decreased by 3,06%, and in CO patients - by 6,3%.

Attention is drawn to the fact that in patients who under our program, there is a probable decrease in the average group value of arterial diastolic pressure of 7.9%.

While the average of the aforementioned indicator decreased by only 3.7% in the KY subjects and continues to remain high for patients aged 69-85.

It is worth noting that, after 21 days of training in the physical cultures, no person with arterial systolic blood pressure of 180 mm Hg had been arrested among the women and men of the CO. Art., and diastolic pressure - 130 mm Hg. Art. Although in the beginning of the study, there were 5 patients and 6 people, respectively. While among the elderly COG at the end of the study, 1 patient had arterial diastolic pressure at 130 mm Hg. Art.

The frequency of cardiac contractions in the studied KGs probably decreased by 2.19%, and in COs by 4.2% and corresponds to the normal values for persons in this age group (norm 75-80 beats per minute).

Unlike the patients of the COG, in the elderly who were engaged in our program, the average changes in mean blood pressure, which, after the completion of the molding study, were 119 ± 1.08 mm Hg, also aroused the probable changes. Art.

In the middle group, the pulse pressure values of both groups decreased, however, there was no significant change (see Table 1).

After 21 days of physical therapy training in persons aged 69-85, a significant increase in mean values of systolic blood volume by 24.09% was recorded (Fig. 1). At the same time, there are no significant changes in this indicator in KG *patients.*

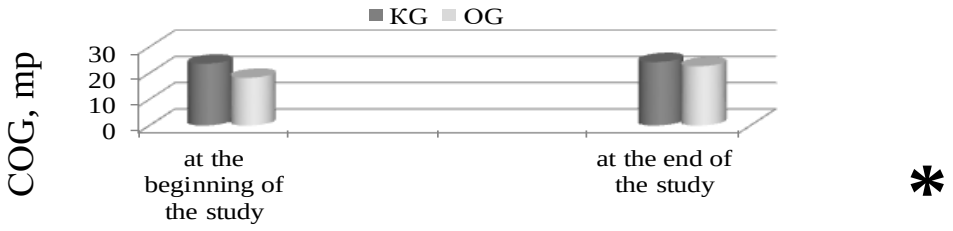

Fig. 1. Dynamics of changes in the average value of CC in persons 69-85 years of control (KG) and main (CO) groups

* - the differences with respect to the initial data are statistically significant (p <0,05)

Attention is drawn to the fact that the patients in both groups continue to show low mean values of central hemodynamics, which characterize the cardiac function of the heart. Thus, the average value of the systolic blood volume after the completion of the molding study in people with CO and OG is less than 60% (the normal value is 50-70 ml).

Given the fact that in the elderly who were engaged in our program, there is a probable reduction in the mean values of heart rate and a likely increase in the mean values of systolic blood volume in them is observed and a possible increase in average values of the indicator, which determines the amount of blood, which is moved by the heart for 1 minute in a large or small circle of blood circulation.

Analysis of the results of the study shows that in patients aged 69-85 years of age, the mean value of the minute volume of blood increased by 1.2% (p> 0.05), while the OG representatives increased significantly by 21.1% (p < 0.05) compared to the output danes, which is higher in percentage terms than in the control group patients.

Figure 2 shows that the average value of the coefficient of efficiency of the circulatory system in men and women of both groups decreased, indicating positive dynamics.

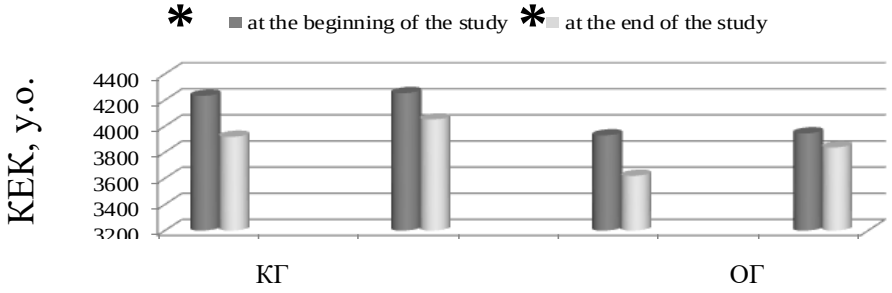

Fig. 2. Dynamics of changes in the average KEK in persons 69-85 years of the control (KG) and the main (CO) groups

* - the differences with respect to the initial data are statistically significant (p <0,05)

It should be noted that at the end of the molding study in women of KG and CO the decrease in the average of the KEC with respect to the day off was 7.4% and 7.9%, respectively, was statistically significant. Men in both groups also experienced a decrease in the average of the above indicator (by 4.7% and 2.7%, respectively), but there was no statistically significant difference.

It should be noted that in percentage terms, the reduction of average values of the coefficient of efficiency of blood circulation in persons 69-85 years of CO is higher than in patients with KG, which testifies to the effectiveness of our developed physical education cultures.

Conclusions.

Analysis and synthesis of literature data on the subject of research suggests that with the age of people there are violations of the cardiovascular system. And data from the World Health Organization state that over the past decades in our country, mortality from diseases of the above system has increased. Consequently, taking into account the above, many researchers are seeking new techniques for the physical rehabilitation of the elderly with cardiovascular diseases.

The main task of physical rehabilitation of patients with diseases of the cardiovascular system is the use of such therapeutic physical culture, which help to normalize blood pressure, improve the function of the cardiorspiratory system and higher nervous activity.

Application in the process of physical rehabilitation of the elderly with diseases of the cardiovascular system of training physiotherapy and massage improves the functional state of patients. Positive functional changes under the influence of occupations according to the proposed program of physical rehabilitation contribute to a veracious reduction in mean values of systolic and diastolic pressure, as well as mean arterial pressure. Patients who were engaged in the program of a medical establishment, registered a probable reduction in only arterial systolic blood pressure.

Physical training in combination with massage helps to improve the average values of systolic and temporal volume of blood in persons aged 69-85.

Patients in the control group and the main groups have registered positive dynamics of changes in the average values of the coefficient of blood flow efficiency.

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