



COMPLEX PHYSICAL REHABILITATION OF WOMEN REPRODUCTIVE AGE WITH STAGE I HYPERTENSIVE HEART DISEASE

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Abstract

Background. Hypertensive heart disease (HD) is a chronic abnormality that affects various systems of the body and is especially unfavorable for women of reproductive age.

The purpose of the study was to develop a comprehensive program of physical rehabilitation for young women suffering with stage I hypertensive heart disease at the outpatient stage of rehabilitation and evaluate its effectiveness.

Materials and methods. 42 young women with a diagnosis of HD were randomly divided into two groups: one performing traditional physical rehabilitation (control group) and the other following a method based on the Pilates system. Questionnaire, Martinet-Kushelevsky test, modified Romberg test, and Deshin test were performed.

Results. Questionnaire and examination for determination of therapeutic tasks in the application of physical rehabilitation show improvement due to the use of the suggested methodology. Indicators of Martinet-Kushelevsky test improved from 2.46 points to 5.48 points ($p < 0.01$) which is better ($p < 0.05$) than in the case of the traditional methodology where they changed from 2.44 to 4.61 ($p < 0.01$). Kotov-Deschin test results show improvement in both groups evenly but the test results of the women of the main group improved from “unsatisfactory” to “good”, and those of the women of the control group improved from “unsatisfactory” to “satisfactory” with significantly better results in the main group ($p < 0.05$). Distribution of the Romberg test results show improvement of vestibular stability in all participants of the main group.

Conclusions. The proposed program of complex physical rehabilitation of patients with stage I hypertensive heart disease using the Pilates method proved to be effective. Due to this program, there was a significant decrease in heart rate, systolic and diastolic pressure, an improvement in the response of the cardiovascular system to the Martinet-Kushelevsky functional test as well as in the state of the respiratory and nervous systems, as evidenced primarily by the indicators of hypoxic tests, spirometry, clino- and orthostatic tests, with the Romberg and Deshin methods.

Keywords: hypertensive heart disease, Pilates, women, blood pressure.

Introduction

Hypertensive heart disease (HD) is a chronic abnormality that affects various systems of the body, characterized by an increase in blood pressure above normal (Shalimova et al., 2020; Shepherd et al., 2016). The disease is underlain by arterial hypertension, which is one of the main risk factors for the development of coronary heart disease, cerebral stroke and other disorders (Shalimova et al., 2019; Rzymiski et al., 2021). All available means and forms of exercise therapy should be used in the system of motor activity of a patient with stage I hypertension, taking into account the use of certain methodological guidelines and rules (Shalimova,

2022; Krivenko et al., 2021). An important problem is the development of a comprehensive program of physical rehabilitation for this category of patients (Maksymenko et al., 2020; Schenström, Rönnerberg, Bodlund, 2006), the need for a deeper study of the pedagogical basis for the use of physical exercises in rehabilitation treatment in stressful conditions in Ukraine especially (Awuah et al., 2022).

Hypertensive heart disease is showing a steady upward trend and this is primarily due to the fact that hypertensive heart disease is a disease of civilization (Polyvianna, Chumachenko, Chumachenko, 2019) its negative aspects (in particular, the information boom, the increased pace of life, hypokinesia, etc.).

The analysis of literary sources showed that hypertensive heart disease occupies one of the leading places among the abnormalities of the cardiovascular system (Yakovlev et

al., 2020). The prevalence of hypertension in women, the chronic course of the disease, the lack of effectiveness of the generally accepted complex therapies determine the relevance of the chosen topic and the need to search for new and effective combinations of physical rehabilitation means that would improve the rehabilitation treatment, would not cause adverse reactions and be well tolerated by women (Podrihalo et al., 2022; Gargin et al., 2019). That is very important for women of reproductive age due to common combination with other disease of genital system (Mączka, Sass, 2017; Lazko et al., 2021; Lytvynenko et al., 2022) that could be realized in later period.

The purpose of the study was to develop a comprehensive program of physical rehabilitation for young women suffering from stage I hypertensive heart disease at the outpatient stage of rehabilitation and evaluate its effectiveness.

Materials and methods

Study participants

We performed primary examination of women suffering from hypertensive heart disease. Under our supervision there were 42 young women (21-30 years old) with a diagnosis of stage I hypertensive heart disease. They were randomly divided into two groups: control (20 patients) and main (22 women). According to the diagnosis, the nature of the disease, age, gender and previous examination, both groups of patients were homogeneous. At the same stage, a program of physical rehabilitation was applied for this contingent of patients. The control group of patients was trained according to the generally accepted method, and the main group according to the method developed by us. Anthropometric data of participants are presented in table 1.

Table 1. Anthropometric data of participants.

Anthropometric data of investigated groups	Control group (N=20)		Main group (N=22)		P
	Mean	SD	Mean	SD	
Age (years)	28.47	3.48	28.13	4.02	p>0.05
Weight (kg)	67.44	5.31	69.04	5.88	p>0.05
Height (m)	1.63	0.11	1.64	0.10	p>0.05

Study organization

The complex of rehabilitation measures in the control and main groups lasted 26-28 days. After that, a second examination was carried out, which made it possible to assess the time course of the indicators of the cardiovascular and respiratory, central and autonomic nervous function, occurring under the impact of the rehabilitation means we used. The results of the re-examination were studied and the effectiveness of the proposed rehabilitation program was evaluated. Evidence-based conclusions were made and practical recommendations were given for participants.

The examined patients of the main and control groups were prescribed a complex of therapeutic exercises and massage according to the generally accepted scheme on a sparing and sparing-training motor regimen (Podrihalo et al., 2021). In the training motor mode, the patients of

the control group were engaged according to the generally accepted methodology, and patients of the main group using the Pilates methods. Classes were held once a day, every day (excluding Sundays) in the hall of therapeutic physical education department. All participants were questioned before and after rehabilitation. Martinet-Kushelevsky test, modified Romberg test, and Deshin test had been performed.

Martinet-Kushelevsky test had been performed measuring blood pressure with a tonometer, determining carpal dynamometry, lung capacity, body length and weight. During its implementation, the subject performed 20 squats in 30 seconds at a pace set from the screen. After the end of the exercise, the program measures the heart rate for 3 minutes and displays the recovery time (in seconds) on the graph. According to the recovery time, the level of physical abilities was assessed: from 1 to 30 s (16-18 points) – high; from 31 to 60 s (13-15 points) – above average; from 61 to 120 s (7-12 points) – medium; from 121 to 150 s (4-6 points) – below average; from 151 to 180 s (1-3 points) – low.

The Kotov-Deshein test was carried out as follows. At rest, the pulse was determined (according to 10-second segments) and blood pressure was measured. Then the subject performed a load in the form of a 2-minute run in place at a pace of 180 steps per minute with a high hip lift. After performing the exercise, the subject sat down and during each of the 5 minutes of the recovery period, his pulse rates were recorded for the first and last 10 seconds, and in the interval between 11 and 49 seconds, blood pressure was measured.

Statistical analysis

Statistical processing of data obtained during the study was carried out using Microsoft Office Excel 2016 spreadsheets (Microsoft, USA) and Statistica 10.0 software (StatSoft, USA). The compliance of the obtained data with the normal distribution law was assessed with the Shapiro-Wilk's W-test. Student's t-test was employed to assess the significance of the difference between independent groups of parametric indicators. The assessment of the significance of differences in the signs of dependent groups with signs of normal distribution was carried out according to the even Student's test (t-test of dependent samples). Differences were determined by the significance level p<0.05.

Results

Results of questionnaire for participants of control and main groups are presented in table 2.

The results of Kotov-Deshein test were evaluated by the increase in pulse and pulse pressure, as well as by the nature and time of recovery and it is presented in Table 4.

Follow-up study of the vestibular stability using the Romberg test is presented in table 5.

Discussion

The initial stage of our work was devoted for the analysis and processing of literary sources on the problem of hypertensive heart disease. The presentation, etiology and pathogenesis of this disease were studied. We have reviewed the available programs of physical rehabilitation

Table 2. Questionnaire of participants about their feeling

Initial parameters	Control group (N=20)		Main group (N=22)		Comparison of groups after the course of rehabilitation	
	After the course of rehabilitation	Initial parameters	After the course of rehabilitation	Initial parameters		
psycho-emotional state	unsatisfactory	3(15.0%)	1(5.0%)	4(18.2%)	-	p<0.05
	satisfactory	14(70.0%)	8(40.0%)	14(63.6%)	3(13.6%)	
	good	3(15.0%)	11(55.0%)	4(18.2%)	19(86.4%)	
adaptation to physical stress	unsatisfactory	19(95.0%)	8(40.0%)	20(90.9%)	9(40.9%)	p>0.05
	satisfactory	1(5.0%)	9(45.0%)	2(9.1%)	10(45.5%)	
	good	-	3(15.0%)	-	3(13.6%)	
general strengthening of the body	unsatisfactory	16(80.0%)	12(60.0%)	17(72.3%)	3(13.6%)	p<0.05
	satisfactory	4(20.0%)	8(40.0%)	5(22.7%)	13(59.1%)	
	good	-	-	-	6(27.3%)	
activity of the cardiovascular system	unsatisfactory	20(100.0%)	9(45.0%)	22(100.0%)	9(40.9%)	p>0.05
	satisfactory	-	11(55.0%)	-	10(45.5%)	
	good	-	2(10.0%)	-	3(13.6%)	
feeling pain from time to time		17(85.0%)	14(70.0%)	18(81.8%)	9(40.9%)	p<0.05
pain in the cervical spine spine		12(60.0%)	8(40.0%)	13(59.1%)	6(27.3%)	p>0.05
pain in the thoracic spine		11(55.0%)	9(45.0%)	11(50.0%)	6(27.3%)	p>0.05
pain in the lumbar spine		11(55.0%)	8(40.0%)	12(54.5%)	3(13.6%)	p<0.01

Table 3. Parameters of the Martinet-Kushelevsky test, points

Parameters	Initial parameters		After the course of rehabilitation		Comparison of initial parameters and after the course of rehabilitation
	Mean	SD	Mean	SD	
Control group (N=20)	2.44	0.21	4.61	0.40	p<0.01
Main group (N=22)	2.46	0.19	5.48	0.37	p<0.01
Comparison between groups	p>0.05		p<0.05		

Table 4. Distribution of the results of the Kotov-Deshin test

Parameters	Initial parameters			After the course of rehabilitation		
	unsatisfactory	satisfactory	good	unsatisfactory	satisfactory	good
Control group (N=20)	19(95.0%)	1(5.0%)	-	10(50.0%)	8(40.0%)	2(10.0%)
Main group (N=22)	20(90.9%)	2(9.1%)	-	6(27.3%)	12(54.5%)	4(18.2%)
Comparison between groups	p>0.05			p<0.05		

Table 5. Distribution of the results of the Romberg test

Parameters	Initial parameters			After the course of rehabilitation		
	unsatisfactory	satisfactory	good	unsatisfactory	satisfactory	good
Control group (N=20)	16(80.0%)	3(15.0%)	1(5.0%)	4(20.0%)	14(70.0%)	2(10.0%)
Main group (N=22)	18(81.8%)	3(13.6%)	1(4.5%)	-	9(40.9%)	13(59.1%)
Comparison of groups	p>0.05			p<0.05		

for hypertensive heart disease (Shalimova, 2022; Pulavskiy et al., 2022; Gevorkyan, Ippolitov, Bocharova 2022). As a result of the analysis of literary sources, the purpose and objectives of the study were formulated and specified, the main approaches to the physical rehabilitation of patients

with hypertension were determined. At the same stage, a program of physical rehabilitation was drawn up using the Pilates health-improving methods.

The rationale for the use of the health-improving Pilates method in patients of the main group in the training motor

mode could be used as traditional therapeutic physical education involves the study of each muscle group separately (Byrnes, Wu, Whillier, 2018), however, a unique healing method developed in the beginning of the 20th century by the German fitness expert Joseph Hubertus Pilates, suggests a system of exercises based on the attitude to the body as a whole.

There are basic principles of the Pilates system: concentration; control; accuracy; breath; center; continuity, smoothness, fluidity of movements (Kashuba et al., 2020). Concentration is an element of the technique that helps to bring the body and spirit together and become calmer internally. Simultaneously with the exercise, it is necessary to create an image of its implementation. With this visualization, the muscles will be subconsciously activated. Control of exercises requires a high degree of coordination and control, since all the muscles involved in the movement must optimally interact with each other. Accuracy in this system, it is not the number of repetitions that is decisive, but the quality and awareness of their implementation. Breath in Pilates exercises, it is about making the center of the body stable. During the training it is recommended to employ thoracic lateral breathing. In this case, the lower part of the chest expands to the sides and back, and at the same time the thin muscles between the ribs are stretched. There is greater mobility in the upper body. Holding the breath during the exercise is not recommended. Center as Joseph Pilates spoke of "Powerhouse", meaning the middle of the body between the pelvis and the rib cage, with the spine as the central axis. Here, first of all, we are talking about four muscle groups: the transverse abdominal muscle, oblique muscles, and pelvic floor muscles. All of them work together and create a muscular corset, which, on the one hand, supports the spine, and on the other hand, makes the stomach taut. Each exercise starts in the center and flows through the limbs. The force that arises in the center coordinates all movements. Continuity, smoothness and fluidity of movements due to soft execution of movements is more important than a high number of repetitions and speed.

As results of our work we could insist, that the health-improving Pilates method involves the achievement of the following positive changes: normalization of blood pressure; strengthening the abdominal muscles; strengthening the muscles of the pelvic floor; improved joint mobility; improved coordination of movements; improved cell supply with oxygen; optimization of the psycho-emotional state (Sofyan, Abdullah, Hafiar, 2022). Optimization of the psycho-emotional state which we obtained in main group is especially important for patients with HD as stress-factor is one of more important in etiology of that disease and we can influent for initial link of pathogenesis.

Systematically conducted physical therapy classes based on the health-improving Pilates complex activate all physiological processes in the body and improve its vital activity. Under the impact of this complex, the activity of the autonomic nervous system increases, the activity of the endocrine glands and the psychological status of the patient improves. This effect is obtained by performing static, breathing exercises for muscle relaxation and others at a slow pace (Nechyporenko et al., 2020; Bales et al., 2020). This results in a decrease in excitation and an increase in inhibition in the central nervous system (Kolupayev et al., 2022).

Following these physical exercises patients' myocardium is found to undergo activation of metabolism and regeneration processes, an increase in blood flow, and an improvement of its nourishment. In this regard, the heart muscle is strengthened and its contractility increases (Arfanda et al., 2022). Tests which were performed, resulted that no one parameter of cardiovascular activity was decreased in comparison with traditional system of rehabilitation.

Thus, the health-improving Pilates complex is a rather specific type of health-improving gymnastics, which gives a rather high effect in the treatment and prevention of patients suffering from stage I HD, subject to specific guidelines.

The study of the cardiovascular and respiratory indicators in patients of the control and main groups showed positive time course was observed in terms of pulse and blood pressure (Mujriah et al., 2022). When comparing the obtained repeated indicators of the cardiovascular and respiratory systems between the control and the main group, no significant differences were found, which indicates a positive effect of complex physical rehabilitation on women in both groups.

Follow-up examination in patients of the control group revealed a decrease in heart rate and blood pressure at rest. After exercise, a higher systolic pressure persisted, but there was no significant decrease in the recovery time of these indicators. In the main group, there was a more pronounced positive trend in terms of heart rate, systolic pressure and recovery time according to Martinet-Kushelevsky and Deshin tests. This indicates an increase in the adaptive capacity of the cardiovascular system of patients in the main group to dosed loads. During the re-examination of the function of the autonomic nervous system after a course of physical rehabilitation, positive time course was established in the main group and slight positive changes in the control group.

Follow-up study of the vestibular stability using the Romberg test detected an improvement in the time to maintain balance, a decrease in tremor of the hands and eyelids, and a decrease in staggering mainly in women of the main group. The percentage of assessments in the performance of the test in women of the main group improved from "unsatisfactory" to "good", and in women of the control group from "unsatisfactory" to "satisfactory" with significantly better results in main group.

Significant reducing of pain feeling in spine was described previously for Pilates complex (Kashuba et al., 2020) but we proved more significant improvement in main group for lumbar area. That is important for background of HD which performs choice of anesthetic medicine not too wide in that suffering (Goncharova et al., 2020; Lyndin et al., 2019).

We could testify according performed study with questionnaire and examination for determination of therapeutic tasks in the application of physical rehabilitation improvement of many states as follows: general strengthening of the patient's body; improvement of the activity of the cardiovascular system; activation of metabolic processes; strengthening and training the heart muscle; regulation of blood pressure and functions of the vestibular apparatus; improvement of psycho-emotional state; normalization of impaired functions of the cardiovascular, respiratory and autonomic systems; increasing the body's adaptation to physical stress.

Conclusions

Thus, our proposed program of complex physical rehabilitation of patients with stage I hypertensive heart disease using the Pilates method is effective and allows healthcare workers to speed up the recovery process in the patient's body. Under the impact of this program, there was a significant decrease in heart rate, systolic and diastolic pressure, an improvement in the response of the cardiovascular system to the Martinet-Kushelevsky functional test, as well as in the state of the respiratory and nervous systems, as evidenced primarily by the indicators of hypoxic tests, spirometry, clino- and orthostatic tests, with the Romberg and Deshin methods. The rationality of the approach significantly increases the effectiveness of treatment, which contributes to an acceleration of the process of recovery of the patient and restoration of working capacity.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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КОМПЛЕКСНА ФІЗИЧНА РЕАБІЛІТАЦІЯ ЖІНОК РЕПРОДУКТИВНОГО ВІКУ З ГІПЕРТОНІЧНОЮ ХВОРОБОЮ СЕРЦЯ І СТАДІЇ

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Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; E – збір коштів

Реферат. Стаття: 6 с., 5 табл., 29 джерел.

Історія питання. Гіпертонічна хвороба серця (ГХ) – це хронічне захворювання, що вражає різні системи організму і особливо несприятливою є для жінок репродуктивного віку.

Мета дослідження – розробка комплексної програми фізичної реабілітації молодих жінок, хворих на гіпертонічну хворобу серця І стадії, на амбулаторному етапі реабілітації та оцінка її ефективності.

Матеріали та методи. 42 молоді жінки з діагнозом ГХ були рандомно розподілені на дві групи: з проведенням традиційної фізичної реабілітації (контрольна група) та методикою за системою пілатес. Проводили опитування, тест Мартіне-Кушелєвського, модифікований тест Ромберга, тест Дешина.

Результати. Про вдосконалення запропонованої методики свідчать анкетування та обстеження для визначення лікувальних завдань у застосуванні фізичної реабілітації. Показники тесту Мартіне-Кушелєвського покращилися з 2,46 бала до 5,48 ($p < 0,01$), що краще ($p < 0,05$) порівняно з традиційною методикою, де він змінений з 2,44 до 4,61 ($p < 0,01$). Тест Котова-Дешина свідчить про рівномірне покращення в обох групах, але тест у жінок основної групи покращився з «незадовільного» до «доброго», а у жінок контрольної групи з «незадовільного» до «задовільного» зі значно кращими результатами в основних групі ($p < 0,05$). Розподіл результатів проби Ромберга свідчить про покращення вестибулярної стійкості в усіх учасників основної групи.

Висновки. Запропонована програма комплексної фізичної реабілітації хворих на гіпертонічну хворобу серця І стадії за методом пілатесу є ефективною. Під впливом цієї програми відбулося значне зниження ЧСС, систолічного і діастолічного тиску, поліпшення відповіді серцево-судинної системи на функціональну пробу Мартіне-Кушелєвського, а також

стану дихальної та нервової систем, про що свідчать насамперед показники гіпоксичних проб, спірометрії, кліно- та ортостатичної проб, тестів Ромберга та Дешина.

Ключові слова: гіпертонічна хвороба серця, пілатес, жінки, артеріальний тиск.

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