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Dynamics of cardiovascular system and adaptive potential in students with chronic bronchitis

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Purpose: *to determine the impact of the physical rehabilitation program on the state of the cardiovascular system and changes in the adaptive capacity of students with chronic bronchitis.*

Material & Methods: *theoretical analysis of literature and generalization of scientific, methodological and specialized literature; pulseometry, arterial tonometry, a technique for determining the adaptive potential by R. M. Baevsky; methods of mathematical statistics.*

Results: *a comprehensive program of physical rehabilitation was made taking into account the two stages of the period of convalescence, clinical and biological recovery, for students of the same group, additional application of varieties of walking and running on various health-normalizing regimes. After applying the program of physical rehabilitation of students of both groups, a slowdown in the recovery of all cardiovascular parameters and changes in the adaptive potential of the circulatory system was noted, however, the best results were obtained in a group of students, additionally, the versions of walking were used in various health-normalizing regimes with a combination of permutations of hand movements.*

Conclusion: *confirmation of the effectiveness of the developed program of physical rehabilitation was a statistically significant improvement in the cardiovascular system, a slowdown in recovery processes after exercise, an increase in the number of students with a state of satisfactory adaptation.*

Keywords: *students, chronic bronchitis, cardiovascular system, adaptive potential.*

Introduction

Among all the population, respiratory diseases are most commonly encountered, the prevalence of which reaches the level of diseases of the circulatory system (from 15% to 20% in different age groups). At the same time, diseases of the respiratory system are characterized by high rates of temporary disability and disability. Today, the state of health of students indicates that this problem is relevant both for the health care system and for the society as a whole. In connection with this, there is a need to develop health programs to support health and healthy lifestyles, including the development of physical rehabilitation programs for various diseases [1]. Chronic bronchitis is a disease with a primary lesion of the airways, which is associated with inflammation or prolonged irritation of the bronchial mucosa by various agents and is characterized by a progressive recurrent course [2]. The development of chronic bronchitis is associated with the action of exogenous and endogenous risk factors.(А. Н. Кокосов, 2005; P. M. A. Calverley, N. G. Koulouris, 2005). Among the exogenous factors are smoking, pollutants of inorganic and organic nature, ecological and climatic factors, low socioeconomic level, some forms of respiratory infection; among endogenous – congenital deficiency of alpha-1-antitrypsin, hyperreactivity of bronchi, prematurity of a fetus at birth [3; 4].

Chronic bronchitis is among the most frequent diseases due to the prevalence among people of working age. The issues of treating and rehabilitating patients are of important medical and social importance [5]. Priority areas in the rehabilitation of patients with chronic bronchitis are methods using non-drug, natural and climatic factors, physical training. For patients with chronic bronchitis at all stages of the course of the disease high efficiency have physical training programs that increase exercise tolerance and reduce shortness of breath and fatigue [6]. According to the experience of medical practice and observations S. N. Zinatulin systematic special breathing exercises allow to significantly increase the efficiency and economy of the function of external respiration, and at the same time increase, make more stable physiological reserves and adaptive capabilities of the organism [7].

According to many authors, in the complex treatment of patients with chronic bronchitis, physical rehabilitation is an integral part and occupies a decisive place among rehabilitation and rehabilitation measures. Under the influence of purposeful and systematic use of therapeutic physical culture, both special and general developmental exercises, the activation of extracardiac factors, coronary circulation by increasing the volume and speed of the circulating blood is greatly improved [8–12].

Thus, despite the available work devoted to the study of methods of diagnosis, prevention and rehabilitation of patients with bronchitis, this problem has not yet been fully studied. Not enough attention is paid to rehabilitation programs, taking into account recovery periods, while this stage is fundamental in the correction of the condition of patients with chronic bronchitis.

Relationship of research with scientific programs, plans, themes. The work is carried out according to the consolidated plan of research work in the sphere of physical culture and sports for 2011–2015. On the theme: "Traditional and non-traditional methods of physical rehabilitation in diseases of various systems of the body and damage to the locomotory system in people of different degrees of training" (code for topic 4.1, state registration number – 0111U000194) and ac-

cording to the priority thematic direction No. 76.35 "Medical and biological substantiation carrying out of restoration measures and appointment of means of physical rehabilitation for persons of a young age of an exhaustive degree of training". State registration number – 0116U004081.

Purpose of the study: to determine the impact of the physical rehabilitation program on the state of the cardiovascular system and changes in the adaptive capacity of students with chronic bronchitis.

Material and Methods of the research

Research methods: theoretical analysis of literature and generalization of scientific, methodological and special literature; pulsometry, arterial tonometry, the method of determining the adaptive potential of R. M. Baevsky; methods of mathematical statistics.

A comprehensive program of physical rehabilitation was drawn up taking into account two stages of the recovery period, clinical and biological recovery. Examination and physical rehabilitation of students with chronic bronchitis, were held at the University Hospital of the Kharkov National Medical University. Under our supervision, there were 73 students aged 17–20 years, which were divided into three groups. MG1 consisted of 25 students who underwent a course of physical rehabilitation in accordance with the developed program with the additional use of walking and walking variants in various health-normalizing regimes, 21 students were assigned to MG2, they were engaged in a program of physical rehabilitation, and 27 students of CG were students who did not have bronchopulmonary pathologies and were engaged in physical education according to the program of the university. The course of treatment was 21 days [2; 8; 9]. All ethical principles for medical research were met, according to the WMA Declaration (Helsinki, 2013).

In the first stage, the students of MG1 and MG2 prescribed therapeutic physical training, massage of the muscles of the body, shoulder girdle, upper limbs; Physiotherapeutic agents: UHF to alternate with solutex on the nasal passage and chest; Internally recommended taking vitamins of group B, C, E; Eleutherococcus (to stimulate the body's resistance). Students of both groups were engaged in therapeutic gymnastics 3 times a week, performing general strengthening and general exercises in relation to respiratory exercises 4:1. The students of OG1 additionally used varieties of walking on various health-normalizing regimes with a combination of permutations of the movements of hands.

At the second stage, MG1 students performed morning hy-

Table 1

Dynamics of indicators of the cardiovascular system in students with chronic bronchitis (MG1 and MG2) when compared with the indicators of healthy students (CG), $\bar{X}\pm m$

No. i/o	Indicators at the stages of rehabilitation		MG1 (n=25)	MG2 (n=21)	CG (n=27)
1.	Heart rate at rest, for 10 s	I II	12,92±1,42* 12,03±1,02 **t=2,27**	12,30±1,14* 11,36±0,45 **t=3,37**	11,84±0,23
2.	HR after load, 10 s	I II	17,76±2,05 17,32±0,97 t=1,06	17,10±1,11 17,03±0,48 t=0,24	17,36±0,34
3.	SBP before load, mmHg	I II	126,16±11,59 121,08±6,72 t=1,99	123,90±7,69 121,19±4,37 t=1,33	120,93±1,38
4.	SBP after loading, mmHg	I II	146,60±6,41* 138,80±6,00 **t=2,27**	142,86±8,60 139,67±5,09 t=1,33	140,56±1,32
5.	DBP before load, mmHg	I II	73,00±6,92 76,92±8,40 t= –1,98	73,33±7,30 73,10±7,66 t=0,10	74,07±1,56
6.	DBP after load, mmHg	I II	96,00±5,95* 90,60±7,40 **t=2,65**	93,33±7,30 93,10±5,80 t=0,13	94,81±1,45
7.	PBP before load, mmHg	I II	53,16±8,41* 44,16±7,25 **t=4,20**	50,57±5,13 48,10±7,65 t=1,06	46,85±1,21
8.	PBP after load, mmHg	I II	50,60±9,28 48,20±8,65 t=1,08	49,52±8,20 46,57±8,72 t=1,28	45,74±1,35
9.	Heart rate recovery time, min	I II	7,40±1,44* 5,46±0,69 **t=5,36**	6,21±1,46* 5,07±0,73 **t=3,57**	6,22±0,31
10.	BP recovery time, min	I II	12,00±3,12* 10,10±1,27 **t=2,88**	10,47±2,13 10,10±0,93 t=0,71	10,61±0,37

Remark. ** – statistically significant difference between indicators (p<0,05).*

Table 2

Dynamics of changes in the adaptive potential of the circulatory system by the method of R. M. Baevsky students of both groups with chronic bronchitis, %

No. i/o	Condition of adaptive potential	Stage	MG1 (n=25)	MG2 (n=21)	CG (n=27)
1.	satisfactory adaptation (not more than 2.1)	I II	59 78	61 69	91
2.	stress adaptation mechanisms (2.11-3.2)	I II	36 22	32 30	9
3.	unsatisfactory adaptation (3,21-4,3)	I II	5 –	7 1	–

gienic exercises in the morning, accelerated walking in the evening for 20 minutes; slow running – 30 min; accelerated walking – 10 min. MG2 students continued to perform the motor tasks of the first stage, gradually completely replacing them with motor programs that included special, basic and simulation exercises with increasing load [13].

Results of the research

After the application of the comprehensive program of physical rehabilitation of students of MG1, proposed by us, the cardiovascular system parameters decreased statistically significant, such as the value of heart rate at rest by 1,07 times, SBP after exercise by 1,04 times, DBP after exercise by 1,06 times, time HR recovery 1,35 times, BP recovery time 1,19 times ($p<0,05$ for all indicators). Indicators of the value of SBP before the load, DBP to the load tended to increase, but still received statistical significance. All this suggests a certain development of the economization of the activity of the heart at rest and during exercise.

MG2 students had a statistically significant decrease in heart rate at rest by 1,08 times ($p<0,05$), recovery time of heart rate by 1,22 times ($p<0,05$), changes in other indicators of statistical significance were not obtained (Table 1).

After the application of the physical rehabilitation program, there was a slowdown in the recovery of all indicators of both MG1 students and MG2 students, however, the best results were obtained in a group of students, and additional types of walking were used.

Health assessment is closely related to the study of the state of adaptation. In order to identify cases of a decrease in the protective-adaptive capabilities of the organism, tension or insufficiency of adaptation mechanisms, the adaptation potential of the circulatory system was calculated using the formula of G. M. Baevsky.

According to the results of the pre-natal examination of MG1 students, 12 students had a satisfactory adaptation, 7 were the tension of the adaptation mechanisms, and 6 students had an unsatisfactory state of adaptation potential. After the proposed program of physical rehabilitation, satisfactory adaptation was observed in 19 students, only 6 people remained in the tension of the adaptation mechanisms, there was no satisfactory state of adaptive potential.

For students of MG2, satisfactory adaptation was observed in 11 people, 6 students identified the stress of adaptation mechanisms, the unsatisfactory state of adaptive potential was in 4 students. The dynamics of the adaptive potential of MG2 students showed that 1 student remained inadequate adaptation status, 6 students were in a state of stress adaptation mechanisms, 14 people acquired the value of the indicator, which corresponds to the value of satisfactory adaptation (Table 2).

The dynamics of changes in the adaptive potential of the circulatory system by the method of R. M. Baevsky students of both groups with chronic bronchitis after the application of the proposed comprehensive program of physical rehabilitation indicates that the best results were obtained in the group of students (MG1), which additionally used varieties of walking.

Conclusions / Discussion

A comprehensive physical rehabilitation program has been developed for students with chronic bronchitis, taking into account recovery periods, especially with the use of therapeutic exercises and walking on various health-normalizing modes with a combination of hand movements' permutations positively influences the state of the cardiovascular system and the adaptive potential of the circulatory system. Statistically significant changes were observed in MG1 students who were engaged in this program. The MG2 students also showed positive changes in cardiovascular parameters, but statistically significant changes received only the value of heart rate at rest ($p<0,05$) and the recovery time of heart rate ($p<0,05$).

The confirmation of the effectiveness of the developed program of physical rehabilitation was a statistically significant improvement in the cardiovascular system, slow down the processes of restoring the cardiovascular system after loading, increasing the number of students with a state of satisfactory adaptation, especially in the case of MG1 students, reducing the stress state of adaptation mechanisms.

Prospects for further research related to the study of the dynamics of the level of physical condition and physical performance in students with chronic bronchitis after the application of the author's program of physical rehabilitation.

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References

1. Mikhaylova, S.V., Sadretdinova, I. & Fedoseeva, Ya. (2015), "Students' health – the social value of the state", *Sovremennye nauchnye issledovaniya i innovatsii*, No. 4, Part 5, available at: http://web.snauka.ru/issues/2015/04/52244 (accessed 07.06.2018) (in Russ.)
2. Petrukhnov, O.D. (2018), "Influence of health-normalizing modes of walking on the state of the respiratory system of students in chronic bronchitis", *Slobozans'kij naukovo-sportivnij visnik*, No. 1(63), pp. 70-74, doi: 10.15391/snsv.2018-1.012. (in Ukr.)
3. Kokosov, A.N. (2000), "Rehabilitation of patients with nontuberculosis diseases of the bronchi and lungs: our experience and perspective on the problem", *Pulmonologiya*, No. 4, pp. 43-47. (in Russ.)
4. Calverley, P.M.A. & Koulouris, N.G. (2005), "Flow limitation and dynamic hyperinflation: key concepts in modern respiratory physiology", *EurRespir J*, No. 25, pp. 186-199. (in Russ.)
5. Malyavin, A.G., Yepifanov, V.A. & Glazkova, I.I. (2010), *Reabilitatsiya pri zabolevaniyakh organov dykhaniya* [Rehabilitation with respiratory diseases], Izdatelskaya gruppa "GEOTAR MYeDIA", Moscow. (in Russ.)
6. Mingazova, L.R., Selezneva, N.I., Kildibekova, R.N. (2012), "Efficiency of Rehabilitation Complexes in Chronic Bronchitis", *Meditsina: vyzovy segodnyashnego dnya: materialy Mezhdunar. nauch. konf. (g. Chelyabinsk, iyun 2012 g.)*, Dva komsomoltsa, Chelyabinsk, pp. 61-62, available at: https://moluch.ru/conf/med/archive/52/2452/ (accessed 18.07.2018). (in Russ.)
7. Chempalova, L.S. (2016), "Formation of physiological reserves and adaptive abilities of the organism under the influence of respiratory techniques", *Molodoy uchenyy*, No. 28, pp. 994-996, available at: https://moluch.ru/archive/132/36861/ (accessed 18.07.2018). (in Russ.)
8. Petrukhnov, O.D. & Ruban, L.A. (2017), "Duration of elimination of violated functions of the respiratory system in students of different levels of trenirovannosti, patients with chronic bronchitis after the application of a comprehensive program of physical rehabilitation", *Scientific Journal "ScienceRise"*, No. 1/1(30), pp. 32-36. (in Ukr.)
9. Ruban L.A. (2012), "Respiratory gymnastics as a means of prevention of respiratory diseases in students", *Visnyk Chernihivskoho natsionalnoho pedahohichnoho universytetu*, Vyp. 98, T. 3, pp. 260-264. (in Ukr.)
10. Pieshkova, O.V. (2011), *Fizychna reabilitatsiia pry zakhvoriuvanniakh vnutrishnikh orhaniv* [Physical rehabilitation in diseases of internal organs], Kharkiv. (in Ukr.)
11. Ruban, L.A. (2013), "Influence of sedentary lifestyle on the state of the respiratory system in students of higher education in Kharkiv", *Slobozans'kij naukovo-sportivnij visnik*, No. 3(36), pp. 113-115. (in Ukr.)
12. Tsiupak, T.Ye., Tsiupak, Yu.Yu. & Filak, F.H. (2017), "Influence of rehabilitation means on the cardiorespiratory system of younger adolescents with chronic bronchitis", *Molodyi vchenyi*, No. 3.1 (43.1), pp. 305-308.
13. Petrukhnov, O.D. & Ruban, L.A. (2017), "Integrated program of physical rehabilitation for students of different levels of trenirovannost, patients with chronic bronchitis of moderate severity during reconvalescence", as well. with. No. 72515 Ukraine / – stated. Apr 10, 2014 No. 73231; post June 27, 2017. (in Ukr.)

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