

Original Article

Ways of improving the efficiency of physical rehabilitation means for patients with generative-distrophic diseases of adolescents

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Abstract:

Purpose: At the present stage of the development of rehabilitation technologies for the prevention of disability due to hip joint osteoarthritis, methods of physical rehabilitation are not effective enough, which negatively affects the quality of life of patients and their social status. The purpose of the study: to develop a program of physical rehabilitation of patients with coxarthrosis and to determine its effect on homeostatic and adaptive reactions of the autonomic nervous system.

Material: During the study of the functional state of vegetative nervous system (VNS) 51 patients with hip arthritis of the I-II radiological stage at Kellgren-Lowrence, it was found that its progression is contributing to a violation of autonomic reactivity and adaptive capacity of the VNS.

Results: The developed complex of physical rehabilitation included an educational program, therapeutic gymnastics, aimed at the gradual application of relaxation gymnastics, exercises for improving the regional microcirculation of the tissues of the joint, the creation of a muscular corset. The methodical features of therapeutic gymnastics for patients with predominance of activity of the sympathetic department of the VNS were: limitation of the volume of loads, slow rate of execution of inertial-kinetic orientation exercises. For patients with predominance of the vagotonic type of response, on the contrary, included exercises that stimulate the sympathetic division of the VNS and facilitate correction of regulatory mechanisms.

Conclusion: As a result of the application of the developed program of physical rehabilitation, the number of patients with a normal VR type increased by a factor of 3time with a decrease in the sympathotonic type of VR by a factor of five. The adaptive capacity of the VNS was resumed in 51,9%: The number of patients with normal vegetative support of activities increased 6,5 time due to a halving of patients with excess vegetative support of activities.

Key words: physical rehabilitation, coxarthrosis, vegetative nervous system.

Introduction

At the present stage of the development of rehabilitation technologies for the prevention of disability due toosteoarthritis of the hipjoint methods of physical rehabilitation are not effective enough, which negatively affects the quality of life of patients, their social status (Korpan, 2011; Bennell, 2010). Overcoming this negative trend is possible by inhibiting the progression of pathological processes in the joints and their functional disorders through physical rehabilitation. Despite the fact that in the last decade the concept of physical rehabilitation of patients with coxarthrosis (CA) significantly changes, but still, the problem of preventing the progression of the disease by means of physical rehabilitation, and thus prevention disability of patients, remains very relevant and not sufficiently developed, which is due to many factors.

The direction of physical rehabilitation is more often based on overcoming the main manifestations of the disease: pain syndrome and functional disorders of the hip joints. In this case, almost no consideration is given to the mechanisms of progression of coxarthrosis, that is, the neglected pathogenetic orientation of approaches to physical rehabilitation, in particular, virtually no consideration of homeostatic and adaptive reactions of the ANS, which is extremely important for a personified approach to physical activity of patients during the use of therapeutic exercises. The problem of coxarthrosis is increasingly considered from the point of view of the systematic organization of the musculoskeletal system and the state of skeletal- muscular homeostasis, taking into account the role of the nervous, hormonal, immune and other functional systems in the development of specific reactions of the individual structural elements of the joint and surrounding its soft tissues, as elements of a single musculoskeletal system (Korpan, 2011; Lebesets, 2013; Eckstein, 2009).

Metabolic processes in cartilage tissue are controlled by many mechanisms. One of the leading regulatory routes is nervous. It is known that the autonomic nervous system (ANS) at any age plays an important role in all metabolic processes, including, in CA (Lebesets, 2013; Bennell, 2010). It is the imbalance in the ANS that is of direct relevance not only in understanding its role in the modulation of osteoclastogenesis and osteoclast activity, but also determined the ability of patients to perform physical exercises (Iba, 2010; Jänig, 2014; Noda, 2010; Togari, 2015). On the other hand, the leading role of the ANS in the formation of motor-visceral reflexes is known, without which the effective implementation of the individual approach to the construction of the program of physical rehabilitation becomes impossible.

Materials and methods

The observation was 51 patients with coxarthrosis I-II stage for radiological Kellgren-Lowrence. The age of patients ranged from 36 to 69 years, with a prevalence of mature patients (55.8%). Among patients, women predominated (61.6%). The duration of the disease in the vast majority of patients varied from 1 to 10 years. The basis for evaluating the functional state of the ANS was to determine its initial vegetative tone (VT) according to the vegetative index of Kerdo (VIK). The autonomic reactivity (AR) was studied using oocerecal samples by Danini-Ašner and based on changes in heart rate (pulse) defined the role of neuro-humoral correlations in maintaining vegetative homeostasis (Baevsky P.M., 1997). Vegetative provision of activities (VPA) was evaluated with the help of experimental modeling physical activity in the clinorostatic test depending on the initial VT. Descriptive statistics were used for statistical analysis of the data. Comparison of mean values of variables was performed using parametric methods (Student's t-test) for the normal distribution of the data expressed in the interval scale. The correspondence of the distribution of the characteristics of the law of normal distribution was checked using the Shapiro-Wilk method. In other cases, a nonparametric method was used (Mann-Whitney U-test). To compare the particle distribution of two or more variables, the χ^2 test was used. Correlation analysis was performed on Pearson (for data expressed on interval scale) and Spearman (for data not expressed on interval scales). All calculations were performed in SPSS 9.0 for Windows.

Results

Studies indicate the predominance of eutonia, which was confirmed by the VIK (2.13 ± 0.7), vagotonia ($-16,5 \pm 3,1$) was observed in 4,3 times less often, sympathicotonia ($13,8 \pm 0,8$) also was less than 7 times, (Fig. 1).

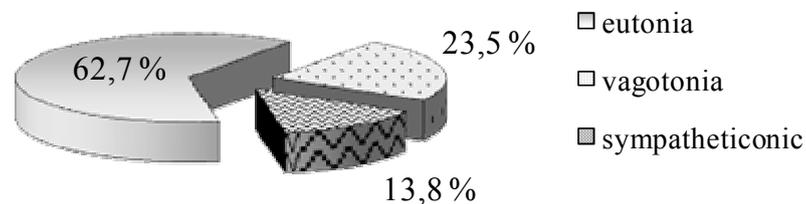


Fig. 1. Frequency of distribution of patients by the type of vegetative tone

Necessary property of the system is the reactivity, which characterizes the direction and degree of changes in the body at the time of transition from one state to another. In this regard, AP was investigated, the characteristics of which are given in Table 1.

Table 1. Characteristics of vegetative reactivity of the examined patients

Output VT	Initial level of HR, ud / min	Type of AR					
		normal		vagotonic		sympatheticonic	
		Heart rate	n (%)	Heart rate	n (%)	Heart rate	n (%)
eutonia n = 32	85.1 ± 1.6	72.6 ± 1.2	21.9	62.5 ± 1.0	12.5	89.9 ± 2.0	65.6
vagotonia n = 12	69.0 ± 2.1	61.8 ± 4.2	41.7	55.6 ± 2.0	41.7	76.0 ± 0.0	16.6
sympathomy n = 7	88.4 ± 4.1	-	0	62.0 ± 0.0	14.3	91.5 ± 4.4	85.7

As can be seen from the data presented, at baseline eutonia, normal AR in only 21.9% of patients reflected sustained homeo-kinetic reactions. Modified AR in the majority of patients by the nature of the reaction is represented by sympathetonic tonic types of reactions, manifested by the absence of a reflex or its invertedness with acceleration of HR in $(6,5 \pm 1,3)$ bpm / min, that is, the stress of the nerve link regulation took place. In some cases, VP showed a vagotonic type of response with a delayed HR at (22.6 ± 4.9) bpm / min, indicating the tension of the humoral link of regulation.

At the initial vagotonia, AR was equally often manifested as adequate response to the sample, as well as the vagotonic type of AR, whereas in the initial sympatheticonianions, the violation of AR in the form of sympathetic reactions in the vast majority of patients indicated an over-voltage of the nerve channel of regulation with a weakening of the humoral, which gives the basis to judge the presence the processes of disintegration between these regulatory links.

In studying the peculiarities of the adaptation processes in the ANS, by estimating the VAH, it was found that only a small number of patients with eutonia responded adequately to physical activity (Fig. 2).

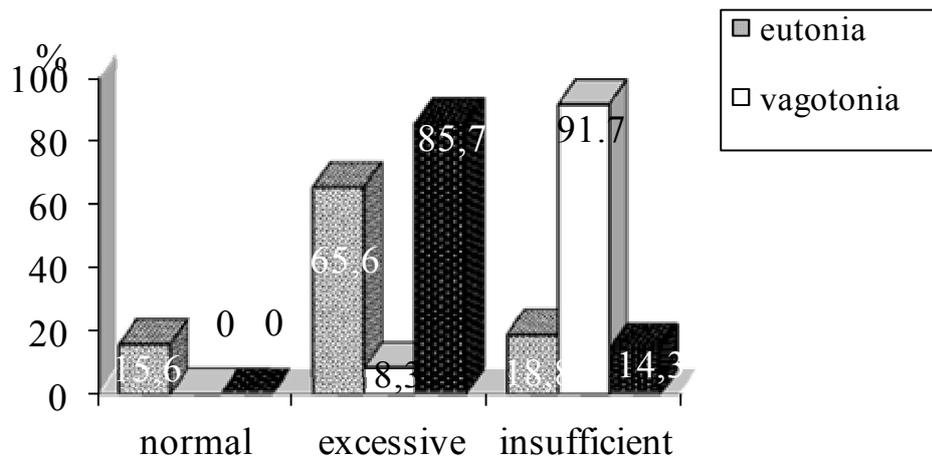


Fig. 2. Structure of types of vegetative provision of physical activity of patients

More specific for patients with erythema was excessive VAH exercise, which was determined by manifestations of sympathetic reactions and indicated the development of a general nonspecific adaptation response by type of mobilization (Maikova,2005).

Insufficient exercise, characterized by the vagotonic type of reactions in 18.8% of patients with eutonium, reflected the tread reaction of the parasympathetic link of the ANS. In the initial vagotonia, the inadequate supportive system prevailed, which was manifested by the vagotonic type of reaction and indicated a violation of the autonomic reflex protective regulation due to the inadequate activity of the sympathetic ANS and the benefits of parasympathetic effects.

Only in rare cases there was an overdose, which was determined by manifestations of sympathetic reactions and reflected adequate physical load of the compensatory reactions of the body (Maikova, 2005).

In the initial sympathetic cohort, the vast majority of patients responded to physical activity with hypersympathetonic reactions, which reflected the stresses of adaptive mechanisms.

Consequently, certain types of adaptive autonomic reactions, which form the integral, interconnected system of processes of adaptive value with known parameters of the ANS, are determined. This fact has been taken into account when developing a complex of physical rehabilitation.

Methodical features of therapeutic gymnastics for patients with predominance of activity of the sympathetic department of the ANS were: limitation of the volume of loads, slow rate of implementation of inertial-kinetic orientation exercises. A special place in exercise therapy was occupied by breathing exercises, which contribute to the removal of nerve strain, translate the initial sympathetic tone into the étone. On the contrary, patients with a predominance of the vagotonic type of response, on the contrary, included exercises that stimulate the development of the sympathetic department of the ANS and contribute to the correction of regulatory mechanisms.

The technology of physical rehabilitation included an educational program, therapeutic gymnastics, aimed at the gradual application of relaxation gymnastics, exercises for improving regional microcirculation of the tissues of the joint, the creation of muscle "corset", using exercises to increase the strength of straight and oblique abdominal muscles, buttock muscles, two-head muscles of the thighs, tibia and calf muscles. This added to the complex kinesitherapy exercises inertia, kinetic exercises, performed at the hip joints relaxed, moderately

–rizkymy ryvkovymy vibrational motion of the trunk, pelvis and hips to the possible limits the mobility of the hip joints and the feeling they moderate pain. At subsequent stages, the formation of a physiological stereotype of walking, aimed at achieving coordination of reduction and relaxation of muscles with walking phases. Physical exercises with sympathetic tonic and vasotonic types of response differed in size of loading, rate of movements, duration of classes, intervals between them, initial level of adaptive potential. To determine the effectiveness of the developed technology of physical rehabilitation, lasting 12 months, all patients were divided into 2 groups: the (main) group consisted of 27 patients at the age (51.8 ± 1.3) years, to which the developed physical rehabilitation complex was used, in The second group (comparison) included 23 patients age (53.3 ± 1.5) years who received a program of physical rehabilitation on the basis of the plan of the medical institution and medical massage.

Discussion

During re-examination of patients, there was an increase in their number of normal type AR 3 times, with vahotonichnymy reactions –in 1.3 times, while reducing the number of patients with type AR sympatotonichnym in 5 times (Fig. 3).

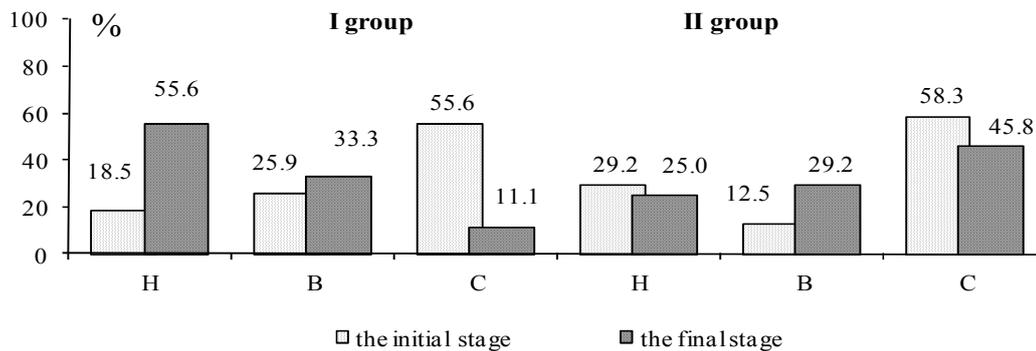
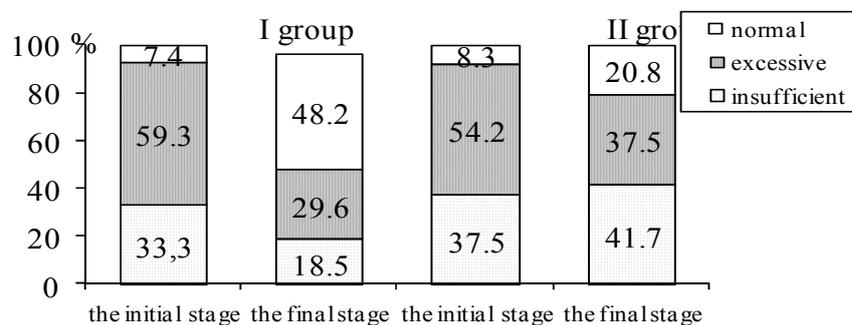


Fig. 3. Dynamics of changes in the structure of types of autonomic response of patients

Among patients of the control group after the end of the course of physical rehabilitation, the number of patients with normal type of AR decreased by 1.3 times, increased by 3.5 times – with vasotonic reactions, with a tendency to decrease the number of patients with sympathonic type of AR in 1,3 times.

In the analysis of changes in the vegetative provision of physical activity, it was established that after the implementation of the program of physical rehabilitation, the number of patients with normal VAH increased by a factor of 6.5, due to the reduction of patients with redundant VAH twice (Fig. 4).

Fig. 4. Dynamics of changes in the structure of types of vegetative provision of physical activity of patients



The number of patients with inadequate VAH also tended to decrease by 1.8 times. Among patients of the control group there was only a tendency to improve the adaptive function of the VAH.

Conclusions

1. The progression of osteoarthritis of the hip joint a contribute to violations of autonomic reactivity with prevalence of sympathonic type of response in the eutonic, vagotonic and sympathomicreactions that gives grounds to judge the availability of disintegration processes between the links of regulation.

2. Violation of the adaptive capacities of ANS in patients with eutonia was characterized by the predominance of excess vegetative provision of physical activity, the initial vagotonia - insufficient pulmonary embolism, which was manifested by the vagotonic type of reactions and indicating a violation of autonomic reflex protective regulation, with the initial sympathetic cytology - Hypersympathicotonic reactions that reflect the tension of adaptive mechanisms.

3. For the restoration of the functional state of the ANS developed a program of physical rehabilitation of patients, the components of which are theoretical training of patients, therapeutic gymnastics with a phased application of relaxation exercises, the creation of muscle corsets, exercises to improve regional microcirculation of joint tissues with the addition of inertial-kinetic gymnastics exercises and the formation of a physiological stereotype of walking. Physical exercises with sympathetic tonic and vasotonic types of response differed in size of loading, rate of movements, duration of classes, intervals between them, initial level of adaptive potential.

4. As a result of the application of the developed program of physical rehabilitation, the number of patients with normal type of AR increased by 3 times with a decrease of 5 times the sympathetic type of AR. The VAH's adaptive capacity was restored to 51.9%: the number of patients with normal AR increased by 6.5 times due to a doubling of patients with surplus VAH.

Conflict of interest

The authors declare no conflict of interest.

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