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Non-pharmacological treatment methods of knee joints osteoarthritis

Abstract. Background. The non-pharmacological treatment methods of knee joints osteoarthritis has been analyzed. The purpose of the study was to analyze the effectiveness of physical (therapeutic) exercises as a component of the tactics of knee joints osteoarthritis treatment and to review physiotherapeutic methods in the treatment of knee osteoarthritis. **Materials and methods.** The authors used the following methods: informational-analytical, bibliometric, structural-logical analysis, system approach. **Results.** The article determines the relevance and expediency of physical exercises and physiotherapeutic methods using in the complex treatment of knee joints osteoarthritis. **Conclusions.** Regular physical exercises may slow down knee joints osteoarthritis progression and obstruct structural changes at the disease. However, it requires thorough study. Problematic issue is to choose an effective program in the context of the content, duration and intensity of the exercises. Physical therapy methods are used to enhance the effect of drugs and simultaneous prophylaxis of the disease. The correct therapeutic physiotherapy methods optimize a body functioning of basic homeostatic systems, increase its reserve capabilities, slow the progression of the disease and accelerate recovery processes.

Keywords: knee osteoarthritis; non-pharmacological treatment; physical (therapeutic) exercises; physiotherapy methods

Introduction

According to statistics, more than 500 000 patients with osteoarthritis (OA) are officially registered in Ukraine and 70–80 % of them are patients with rheumatic diseases. Today, every 5th patient who has applied for medical care to a general practitioner complains of joint pain.

About 50 % of patients with chronic pathology do not follow the prescribed treatment. The results of such irresponsible behavior of the patient increases the disease symptoms and progression, deteriorates of a prognosis of the disease and a life quality, increases the costs for the health care system [21].

The main predictors of the patient's low compliance are: health systems' deficiency (inadequate monitoring, poor level of doctor-patient interaction, inaccessibility of medical facilities and/or medicines, high cost of treatment); peculiarities of treatment (complexity of therapeutic schemes, side effects, asymptomatic course of the disease); personal characteristics of the patient (psychological problems, including depression, cognitive impairment, lack of physical ability to receive treatment, lack of faith in the result, misunderstanding of the essence of the disease) [22, 30].

Timely and correct interpretation of disease, the appointment of adequate, including pathogenetic, treatment in many respects determine the further prognosis and

course of the disease, quality of life of the patient and the preservation of efficiency [30].

During differential diagnosis of articular syndrome, an important role is played by:

- gender, age, occupation, lifestyle of the patient;
- daily dynamics of pain syndrome;
- pre-conditions (trauma, infection, the nature of the food, the use of drugs, the presence of eye diseases).

Patient examination and medical history is used to find out:

- the nature of the onset of the disease — acute, subacute, chronic, paroxysmal (gout), recurrent, progressive;
- the nature of the pain — inflammatory or mechanical;
- prevalence (monoarthritis/polyarthritis), localization (large/small) and symmetry of joint damage;
- presence of extra-articular manifestations.

If a family doctor at an examination of a patient did not mark the preliminary trauma that caused pain, then the articular syndrome is associated, most likely, with osteoarthritis (OA). At OA first of all, the joints that carry constant load (knee and hip) are affected, that significantly impairs the quality of life of patients due to persistent pain syndrome and is a serious socio-economic problem [7]. Pain syndrome with OA, according to the latest data, increases

cardiovascular mortality and mortality [6]. Thus, OA affects a life expectancy and is one of the main causes of premature loss of disability and requires cost of medical care. With the disease progression, there is a need for endoprosthetics, that increases the considerable financial costs and the need for additional funds for patient care [8].

OA significantly impairs the quality of human life, because it is accompanied by severe pain, limitation of the function of the joint, And in the absence or in the case of improper treatment, often causes disability of the patients. Especially on the example of OA of the knee (OAK) — the most common pathology, that occupies the 11th place among the diseases of high contribution to global disability. According to statistics, osteoarthritis of the knee affected 4 % of the total population of the planet [21]. So it is obvious that prevention and treatment of this disease is a serious health problem not only in Ukraine but also in the whole world. So it is very important to provide active prophylaxis and early detection of risk groups in patients with a high probability of morbidity [32].

Osteoarthritis risk factors are: local risk factors that can be modified (muscle strength, physical activity/occupation, joint damage, position of the joint/axis, uneven length of the lower extremities), systemic risk factors that can be modified (obesity, diet, bone metabolism tissue), systemic risk factors that cannot be changed (age, gender, genetic features, ethnicity). So many factors contributing to the development of osteoarthritis are subject to modify, and this relates to the competence of primary care physicians [20].

The purpose of the study is to present an analysis of the effectiveness of physical exercises using in the tactics of knee joints osteoarthritis treatment and a review of physiotherapeutic methods in the treatment of knee osteoarthritis.

Materials and methods

The authors used the following methods: information-analytical, bibliosemantic, structural-logical analysis, system approach.

Results and discussion

The main tasks of OA therapy are: reduction of symptoms and delayed progression of the disease, improvement of functional activity, improving the quality of life of the patient. The use of a combination of therapies for patients with OA is reflected in the recommendations of the European Anti Rheumatic League (EULAR) [11], the European Society for the Clinical and Economic Aspects of Osteoporosis and Osteoarthritis (ESCEO) [3, 4], the International OARIS Scientific Society (OARSI) [19]. The choice of tactics for the management of patients with OA should be made due to the presence of comorbid diseases: arterial hypertension, coronary heart disease, diabetes mellitus, obesity, chronic obstructive pulmonary disease, gastrointestinal tract (GI). The new OARSI recommendations offer the clinician a personalized approach to the choice of therapeutic therapy, based on an analysis of the patient's comforts for risk assessment and safety of prescribed drugs [18, 19].

In the treatment of OAK a special place is occupied by non-pharmacological methods of treatment — physical (therapeutic) exercises, the use of knee tires and insole, thermal therapy, manual therapy, traction therapy, acupuncture, CESN (percutaneous electron stimulation of nerves). In some international guidelines, physical exercises are offered as first-line therapy [7]. According to the author's group (Cochrane Musculoskeletal Group) physical activity can help with OAK by increasing muscle strength, which in turn, reduces the load on the knee joint. Rhythmic contractions and relaxations of skeletal muscles, tension and relaxation of tendons contribute to the improvement of venous outflow, prevention of venous stasis, normalization of microcirculation in tissues. Such exercises prevent the development of atrophy and degenerative changes in tissues and organs [7, 9].

The therapeutic exercises training for patients is a compulsory component of all therapeutic programs in OA and conducted by taking into account the individual characteristics of the patient. Obligatory for the patient is to make daily physical activity, that support muscle tone and spreads on the articular surfaces minimally [13, 15, 16].

The main tasks facing for therapeutic exercises are:

1. Reduced intensity of pain syndrome.
2. Restoration and preservation of the basic functions of the joints.
3. Removal of atrophy of muscles.
4. Strengthening of muscles.
5. Improvement of efficiency.
6. Improvement of microcirculation in the joint and periarticular tissues, blood circulation functions, respiration, metabolism.
7. Restoration of the motor stereotype.
8. Increased overall tone of the body.

Therapeutic exercises are used in three modes: sparing (in the acute period it is, mainly, treatment position and isometric relaxation); therapeutic — trainer (used in the subacute period) and the trainer (appoint at the stage of incomplete remission) [1].

The Cochrane review showed that 54 relevant randomized controlled trials (RCT) examined the effects of the above-mentioned knee pain interventions, their functioning, and quality of life for patients. For each result, the authors used the GRADE (Grades of Recommendation, Assessment, Development and Evaluation) [21].

High-quality evidence from 44 trials (3537 participants) indicates that exercise reduced pain (standart mean difference (SMD) 0.49, 95% confidence interval (CI) 0.39 to 0.59) immediately after treatment. Pain was estimated at 44 points on a 0 to 100-point scale (0 indicated no pain) in the control group; exercise reduced pain by an equivalent of 12 points (95 % CI 10 to 15 points). Moderate-quality evidence from 44 trials (3913 participants) showed that exercise improved physical function (SMD 0.52, 95% CI 0.39 to 0.64) immediately after treatment. Physical function was estimated at 38 points on a 0 to 100-point scale (0 indicated no loss of physical function) in the control group; exercise improved physical function by an equivalent of 10 points (95% CI 8 to 13 points). High-quality evidence from 13

studies (1073 participants) revealed that exercise improved quality of life (SMD 0.28, 95% CI 0.15 to 0.40) immediately after treatment. Quality of life was estimated at 43 points on a 0 to 100-point scale (100 indicated best quality of life) in the control group; exercise improved quality of life by an equivalent of 4 points (95% CI 2 to 5 points).

In general, analysis confirmed the effectiveness of exercise in the OAK. The absolute reduction in the severity of pain in the average study was 12 % (10–15 %), and relative — 27 % (21–32 %). Physical functioning index was 10 and 26 % respectively.

In these studies, various exercises were used, from the strength training of the quadriceps (extension in the knee joint in the position of lying or sitting) to complex exercises with load on various muscles of the lower extremities, stretching exercises and aerobic loading (metered walking or exercise bike). Exercises were mostly moderated in intensity. Power exercises often began with low intensity and gradually increased the load to the maximum endurance. Aerobic exercises were mostly performed with an intensity of 50–70 % of the reserve heart rate (HR) or 60–80 % of maximum heart rate [11]. Static stress leads to intense muscle development and an increase in the mass of hypothyroid muscles, with minimal stress on the affected joint during exercises [28].

The need of strengthen muscles in osteoarthritis is due to the fact that the patient usually protects the diseased joint, resulting in a decrease in the tone of the regional muscles and the relative predominance of the muscles of the opposite side. That changes posture and leads to a violation of the congruence of the articular surfaces of the affected joint and promotes the progression of the disease. The application of therapeutic physical training in this case contributes to the optimization of the functioning of the muscular-ligament apparatus, the restoration of the normal axial load, that creates conditions for the stabilization of the affected joint [8, 10].

Hypodynamia due to pain in OA leads to hypotrophy and a decrease in the volume of muscles located around the joint, which causes its destabilization. Exercises are needed to increase muscle strength and endurance, they improve flexibility and movement in the joint, increase aerobic activity, contribute to lower body mass [26].

Physiotherapy methods that are used to improve the effectiveness of drugs and the simultaneous prevention of the disease are: strengthening the adaptive-trophic functions of the sympathetic nervous system; improved metabolism and trophics of the affected joint; providing analgesic effect; prevention of progression of the degenerative process; acceleration of the restoration of joint functions.

At the same time, physiotherapeutic methods based on the use of an alternating electromagnetic field showed a good effect at the OA of the knee joint. Thus, according to the meta-analysis, 14 RCTs (n = 930), using this method indicated a significant decrease in pain, as opposed to placebo PB [24]. According to another meta-analysis, which included the data of 9 RCTs (n = 636), the mean value of the TL for the pain relief level for OCS was 15.1 mm by 100 mm VAS (Visual Analog Scale) [17].

Acupuncture is widely used throughout the world. Its use was approved by the American College of Rheumatologists as a method that represents the value of pain relief in OAK [19]. According to the results of the meta-analysis of 16 RCTs (n = 3498), acupuncture provided statistically significant but short-term and very small reduction of pain in the OAK: the difference from the false acupuncture was only 0.9 points for the 20-point VAS (absolute difference 4.59 %) [18]. The authors of a later meta-analysis, based on the results of 12 RCTs and less clinical material (n = 1763), determined the existence of significant differences between true and false acupuncture in terms of pain relief, improvement in function and quality of life in OAK [21].

Electroneurostimulation is a method of physiotherapy, consisting in the therapeutic application of impulse currents to restore the activity of organs and tissues that have lost their normal function [29]. Percutaneous electroneurostimulation (PENS) is a variant of electroneurostimulation, that primarily affects sensitive afferent conductors.

The effectiveness of PENS in OAK was confirmed in a series of clinical studies, the results of which were summarized in the meta-analysis of M. Osiri et al. [24]. RCG C.G.T. Vance et al. [29] proved that CHENS has an analgesic effect, and mainly due to the effect on pain during movement, that contributes to the improvement of the function of the affected joint.

In turn, dynamic electroneurostimulation (DENS) is the method of PENS, that consists in the influence on the reflexogenic zones and acupuncture points of electric current impulses, the shape of which depends on the dynamics of the change in the total electrical resistance (impedance) on the sub-electron site of the skin and change ARE during the procedure. That minimizes the effect of adapting excitable tissues to stimulation and, therefore, allows to apply DENS for a long time without losing the effect. At the OAK DENS operates on the main pathogenetic links of pain. Pulses that dynamically change the shape result in the activation of nerve fibers of different diameters, that simultaneously can suppress the activity of the nociceptive system and activate the anti-nociceptive system. A significant role in the formation of therapeutic action is also played by the psycho-physiological phenomena of distraction and the suggestive effect [4, 5].

One of the most actively studied methods of modern physiotherapy, that is widely used in diseases of the musculoskeletal system of traumatic and inflammatory genesis with the therapeutic and prophylactic [25] goal, is extracorporeal shock wave therapy (ECHT). The perspective and high efficiency of EWT are noted by many authors [2, 8, 13]. The method is based on the transformation of electromagnetic oscillations into acoustic waves of the infrasonic spectrum. Shock waves are defined as pressure waves [13], where the pulse pressure rises from 5 to 120 MPa for 5 ns, and then decreases to 20 MPa [26]. The depth of influence is determined by the method of generating pulses (electrohydraulic, piezoelectric, pneumatic, electromagnetic), their amplitude and frequency characteristics [8].

Conclusions

OA treatment still remains a complex and an unresolved problem. Traditionally drug using in OA therapy is relatively ineffective in terms of achieving sustained long-term remission. Great opportunities in this regard have a therapeutic physical factor, the correct use of which enhances the action of drugs, optimizes the functioning of the main body homeostatic systems, increases its reserve capacity, inhibits the disease progression and accelerates the course of recovery processes.

It is obvious that regular physical exercises may slow down of OA knee joints progression, by preventing structural changes in this disease. However, it requires a detailed study in future works. Problem issues remain in choosing an effective program in the context of the content, duration and intensity of exercises.

Physiotherapeutic methods enhance the effect of pharmacological treatment, relieve inflammation, reduce of pain syndrome, prevent of degeneration of articular cartilage, have a reparative-regenerative effect, and provide for the restoration of functional joint activity.

All these data indicate that non-pharmacological treatment should be more widely implemented in a practice of a practitioner for the patients with OA knee joints treatment and prevention of this disease progression.

Conflicts of interests. Authors declare the absence of any conflicts of interests that might be construed to influence the results or interpretation of their manuscript.

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Нефармакологічні методи лікування остеоартрозу колінних суглобів

Резюме. *Актуальність.* Проведено аналіз нефармакологічних методів лікування остеоартрозу колінних суглобів. *Мета дослідження:* провести аналіз ефективності застосування фізичних вправ у тактиці лікування остеоартрозу колінних суглобів та зробити огляд фізіотерапевтичних методів, що використовуються в комплексному лікуванні остеоартрозу колінних суглобів. *Матеріали та методи.* Автори застосували такі методи: інформаційно-аналітичний, бібліосемантичний, структурно-логічний аналіз, системний підхід. *Результати.* У статті визначені актуальність і доцільність використання фізичних вправ та фізіотерапевтичних методів у комплексному лікуванні остеоартрозу колінних суглобів. *Висновки.* Регулярні фізичні вправи можуть уповільнити прогресування остеоартрозу колінних суглобів, тобто перешкоджати структур-

ним змінам при даному захворюванні. Однак це вимагає детального вивчення в майбутніх дослідженнях. Проблемні питання залишаються у виборі ефективної програми в контексті змісту вправ, їх тривалості та інтенсивності. Для підсилення ефекту лікарських засобів й одночасної профілактики захворювання застосовуються фізіотерапевтичні методи. Великі можливості в цьому плані мають лікувальні фізіотерапевтичні методи, правильне використання яких оптимізує функціонування основних гомеостатичних систем організму, підвищує його резервні можливості, гальмує прогресування хвороби і прискорює перебіг відновних процесів.

Ключові слова: остеоартроз колінних суглобів; немедикаментозне лікування; фізичні вправи; фізіотерапевтичні методи

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Нефармакологические методы лечения остеоартроза коленных суставов

Резюме. *Актуальность.* Проведен анализ нефармакологических методов лечения остеоартроза коленных суставов. *Цель исследования:* провести анализ эффективности применения физических упражнений в тактике лечения остеоартроза коленных суставов и сделать обзор физиотерапевтических методов, которые используются в комплексном лечении остеоартроза коленных суставов. *Материалы и методы.* Авторы применили следующие методы: информационно-аналитический, библиосемантический, структурно-логический анализ, системный подход. *Результаты.* В статье определена актуальность и целесообразность использования физических упражнений и физиотерапевтических методов в комплексном лечении остеоартроза коленных суставов. *Выводы.* Регулярные физические упражнения могут замедлить прогрессирование остеоартроза коленных суставов, то есть препятствовать структурным изменениям

при данном заболевании. Однако это требует детального изучения в будущих исследованиях. Проблемные вопросы остаются в выборе эффективной программы в контексте содержания упражнений, их продолжительности и интенсивности. Для усиления эффекта лекарственных средств и одновременной профилактики заболевания применяются физиотерапевтические методы. Большие возможности в этом плане имеют лечебные физиотерапевтические методы, правильное использование которых оптимизирует функционирование основных гомеостатических систем организма, повышает его резервные возможности, тормозит прогрессирование болезни и ускоряет течение восстановительных процессов.

Ключевые слова: остеоартроз коленных суставов; немедикаментозное лечение; физические упражнения; физиотерапевтические методы