



POTENTIAL NEGATIVE EFFECTS OF OSTEOARTHRITIS ON THE CARDIOVASCULAR SYSTEM AND THE ROLE OF REHABILITATION IN THEIR REDUCTION

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ABSTRACT

The aim of this report is to present the significance of osteoarthritis in occurrence and development of certain cardiovascular diseases, and the potential benefits of physical medicine therapeutic interventions for their prevention and treatment.

MATERIALS AND METHODS: A review was conducted of available scientific sources containing data on the impact of osteoarthritis on cardiovascular diseases and the role of rehabilitation in their prevention and treatment.

RESULTS: The review revealed evidence of a mutual connection between osteoarthritis and certain cardiovascular diseases. There are scientific data indicating common risk factors such as age, obesity, and genetics. Another mechanism affecting the cardiovascular system is the use of medication to control osteoarthritis symptoms. Non-steroidal drugs prescribed to reduce pain and inflammation may lead to cardiac damage. Pain from osteoarthritis reduces physical activity and leads to increased intake of pharmacological agents. Physical activity and therapeutic exercises can have a positive effect both on osteoarthritis and on accompanying cardiovascular conditions.

CONCLUSION: The potential impact of osteoarthritis on cardiovascular diseases is a focus of attention in recent years. Due to the presence of common risk factors and pathogenic mechanisms, research continues for potential therapeutic effects of physical modalities application for prevention and control of their progression.

Keywords: degenerative musculoskeletal diseases, cardiovascular diseases, preventive care, physical activity, physical modalities, therapeutic exercises.

INTRODUCTION

Osteoarthritis (OA) is a common degenerative joint disease caused mainly by damage of the articular cartilage. Clinically, these changes in the joint are accompanied by pain, stiffness, and impaired muscle function. Over time, the disease progresses, causing chronic long-term damage not only to the musculoskeletal system but also to other systems in the body (1). These changes are probably related to daily physical activity, as low levels of activity are associated with the occurrence and development of a number of systemic disorders such as metabolic

syndrome, cardiovascular, endocrine, and other diseases. The main risk factors include age, obesity, inflammation, trauma, and genetic factors. The prevalence of OA is increasing with the aging of the population worldwide (2-8).

According to WHO data, there is an increase in the number of people suffering from OA by more than 113% in 2019 compared to 1990 (9). The elderly population over 55 years of age predominates, representing over 70% of all people suffering from some form of OA. There is a tendency for women to be more severely affected. The most commonly affected joints are the knees, hips, and hands. Patients more often have moderate to severe OA. It is believed that these degrees of damage can be successfully treated through rehabilitation (9-12). With an aging population and increasing levels of obesity and trauma, the prevalence of

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osteoarthritis is expected to continue to grow worldwide (13).

Cardiovascular diseases (CVD) are a leading cause of death. They include both heart and vascular diseases such as arrhythmias and coronary artery disease (14). One of the most common forms of arrhythmia is atrial fibrillation (Afib) (15). It has been established that it is one of the main risk factors for fatal incidents (death), cerebral infarction (stroke), and other diseases, the frequency of which is increasing over time. According to the Framingham Heart Study, there has been a threefold increase in the incidence of Afib over the past fifty years (16, 17). Age is a significant risk factor for the occurrence of Afib. It has been determined that its prevalence covers up to 10% of people aged over 75 (17, 18). In addition, age is also a major non-modifiable risk factor for the onset and development of OA (1). Coronary artery disease is the leading cause of death related to cardiovascular disease. It is observed in almost 45% of fatal cases (3, 19). OA can increase the risk of CVD: venous thromboembolism, pulmonary embolism, ischemic stroke, atrial fibrillation, and coronary artery disease (20, 21). Regular consultations and physical examinations of patients with OA can detect the presence of CVD at an early stage (3).

OA and CVD share several risk factors such as hypertension, diabetes, dyslipidemia, and obesity (22-24). Overweight and cardiovascular disease, combined with immobility and reduced physical activity in patients with metabolic syndrome, are often associated with low-grade inflammation (25), which is also found in patients with OA (26, 27). Currently, the involvement of IL-1 β in the pathogenesis of CVD and OA has been established (28, 29). The use of nonsteroidal anti-inflammatory drugs (NSAIDs) for pain control and reduction may increase the risk of cardiovascular incidents. It is believed that the main mechanism by which NSAIDs can lead to heart failure is their ability to suppress prostaglandin synthesis in the kidneys. This causes vascular spasm of the small afferent artery and effectively causes sodium and fluid retention (30, 31). On the other hand, there are studies showing that some drugs used to treat cardiovascular disease can have a positive effect on reducing the incidence of OA. It is believed that drugs that modulate the angiotensin-

aldosterone system may have a positive effect on cartilage regeneration. Other benefits would be provided by beta-blockers, which inhibit beta-adrenergic receptors. They can influence the formation of cartilage tissue by reducing the negative effects of the adrenergic system on cartilage genesis (28).

On the other hand, research continues on the role of genetic factors as risk factors for the occurrence and development of OA and cardiovascular diseases. There are probably common genetic mechanisms, some of which are still unknown (16, 32). Risk factors for the development of CVD, such as age, hypertension, diabetes, obesity, and low physical activity, are associated with both the development and progression of OA (3). Reduced physical activity and muscle weakness, which are common characteristics of patients with knee osteoarthritis (KOA), are associated with an increased risk of CVD and mortality. OA, and in particular knee OA (KOA), is a major cause of disability and muscle weakness in elderly people and causes limitations in physical activity. Reduced physical activity is an important risk factor for CVD (32). In addition, pain in OA reduces levels of physical activity, which is a significant risk factor for the development of CVD (3).

The shared pathophysiological pathways and risk factors suggest a link between the two diseases (32, 33). Park D. et al. (2023) report that knee OA may increase the risk of cardiovascular disease by 1.26 times. They also found that OA increases the risk of myocardial infarction by 1.20 times and stroke by 1.29 times compared to healthy individuals without OA (32). A higher risk of cardiovascular disease has also been found in patients with OA of the knee who are under 65 years of age. In patients with knee OA who are physically inactive and do not exercise, the risk of CVD increases by 1.25 times compared to individuals who do not exercise but do not have OA. According to these researchers, lack of exercise and physical activity may have a mutually reinforcing negative effect on the relationship between gonarthrosis and CVD. On the other hand, the researchers did not observe a significant increase in the risk of CVD in patients with knee OA who exercise at least once a week. According to them, no association can be established between OA of knee joints and death by any cause. Knee OA is independently

associated with an increased risk of CVD. However, their findings regarding the risk of CVD in patients with OA who exercise once a week or regularly is that these activities may have positive implications. In such patients, the risk does not differ from that in people who do not have OA and do not exercise (or do not engage in regular physical activity) (32).

It is recommended that patients with OA undergo regular check-ups, during which diseases of the musculoskeletal and cardiovascular systems can be detected at an early stage. (3). This will enable the appropriate diagnostic, therapeutic, and rehabilitative interventions to be implemented. Increased physical activity, therapeutic exercises, and rehabilitation are key elements in preventing and managing both osteoarthritis and cardiovascular diseases.

PURPOSE OF THE STUDY

The aim of this report is to present the significance of osteoarthritis with regard to the onset and development of certain cardiovascular diseases, as well as the potential benefits of using physical medicine therapeutic interventions for their prevention and treatment.

MATERIALS AND METHODS

A review was conducted of available scientific sources containing data on the impact of osteoarthritis on the onset and development of cardiovascular diseases and the role of rehabilitation in their prevention and treatment. Scientific articles were searched for in the Web of Science, Science Direct, Pubmed, Google Scholar, and PEDro databases, including controlled and randomized studies, systematic reviews, meta-analyses, WHO reports, and recommendations from scientific societies dealing with osteoarthritis, cardiovascular disease, and diabetes mellitus. For this purpose, a search was conducted using keywords relevant to the study of the current problem: osteoarthritis, cardiovascular diseases, degenerative musculoskeletal diseases, relationship between osteoarthritis and cardiovascular diseases, relationship between physical activity and osteoarthritis, physical fitness and cardiovascular disease, risk factors, overweight, metabolic disorders, metabolic syndrome, diabetes mellitus, dyslipidemia, atrial fibrillation, coronary artery disease, myocardial infarction, adverse effects of pharmacological therapy, nonsteroidal anti-

inflammatory drugs and side effects, physical fitness, functional activity, sensitivity to physical activity, muscle function, muscle imbalance, pain, activity-related pain; chronic pain, mechanical pain; musculoskeletal pain, pain-related function, stiffness, physical modalities, electrostatic field, rehabilitation, therapeutic exercises, psychological factors; behavioral therapy, lifestyle, prophylaxis, preventive care, prevention.

RESULTS

The review found evidence of a correlation between osteoarthritis and certain cardiovascular diseases. Scientific data show that there are common risk factors: age, obesity, and genetics. Another mechanism by which the cardiovascular system can be damaged is through the use of medications for controlling the symptoms of osteoarthritis. Nonsteroidal drugs prescribed to reduce pain and inflammation can lead to heart damage. The pain associated with osteoarthritis reduces physical activity and suggests the use of pharmacological agents. Physical activity and therapeutic exercises can have a positive effect on both osteoarthritis and concomitant cardiovascular diseases.

DISCUSSION

The present review aimed to explore and present the significance of osteoarthritis for the occurrence and development of certain cardiovascular diseases, as well as the potential benefits of rehabilitation using physical medicine for their prevention and treatment. Evidence was found showing many similarities and interrelationships in terms of etiology, pathogenetic mechanisms of onset and development, lifestyle, etc. Currently, there is data showing that OA and CVD can influence and potentiate each other (32).

A recently conducted study found that patients with OA who experience high levels of pain have correspondingly lower levels of physical activity, cardiovascular endurance, reduced muscle strength, and flexibility of body structures (34). Pain is the leading symptom reported by patients. Its intensity is a very important factor that influences activity and physical function (35). Reduced functional activity due to the sensation of pain leads to a decrease in certain functional indicators, such as walking distance, standing up from a seated position, and others. On the other hand,

improved physical activity leads to better functional outcomes (36, 37). Regular therapeutic exercises and rehabilitation interventions are important for modifying risk factors (obesity, diabetes, and hypertension) in OA and CVD. These interventions have the ability to improve the control of blood sugar and lipid profiles, which can have a beneficial effect on weight and resting blood pressure levels. Although therapeutic exercise has proven effectiveness (38), the assumption that therapeutic exercise can provoke more pain and/or worsen the clinical course of OA is subject to debate (32).

According to some authors, people who have higher levels of physical activity experience a later onset and slower progression of OA (36). Increased physical activity is associated with lower pain levels in patients with OA (39). Suddenly engaging in physical activity that is not regular and lasts for a short time may cause an increase in pain episodes. In this sense, the link between high physical activity and less pain is based on the fact that long-term and regular physical activity has longer-lasting positive effects on muscles and joints. It has a better effect on the psychological and behavioral functioning of patients associated with pain compared to short-term physical activity (40). However, one of the mechanisms that explains the reduction in pain after exercise, known as acute exercise-induced hypoalgesia, can lead to a short-term episode of pain reduction (41). However, the duration of this period of pain relief and its role in the long-term reduction of pain as a result of therapeutic exercise remains to be clarified (42).

In addition, health education should be promoted to reduce the incidence of cardiovascular disease through lifestyle changes in patients with OA (3).

The process of changing the understanding of the onset, interrelationship, and coexistence of OA and CVD requires the development of adequate clinical approaches for treatment and rehabilitation. In recent years, emphasis has been placed on the role of physical activity and therapeutic exercises for the prevention and, if necessary, rehabilitation of patients with OA and CVD. The appropriate comprehensive application of physical medicine could provide effective, low-risk, and low-cost strategies for the management and rehabilitation of OA and

cardiovascular diseases. Regular physical exercise leads to improved mechanical properties of the joints, improved muscle function, reduced mechanical stress, in addition to weight reduction and reduced inflammatory activity, which often accompany OA (43,44). Chronic pain and reduced functional activity require long-term treatment, which is associated with increased financial costs for the healthcare system. (9). Pain associated with osteoarthritis reduces physical activity and requires the use of pharmacological agents, which can further exacerbate cardiovascular problems. Physiotherapy plays an essential role in the treatment and rehabilitation of patients. Improving physical activity and conducting regular sessions of therapeutic exercises can have a positive effect on both osteoarthritis and cardiovascular diseases. However, the search for a more effective and long-term program for managing symptoms in cases of coexisting degenerative joint and cardiovascular diseases continues (45, 46).

If there are no contraindications, it would be appropriate to add therapeutic sessions with a low-frequency alternating electrostatic field to rehabilitation programs in order to reduce pain, swelling, and stiffness. Deep Oscillation® therapy has a number of advantages (low current strength up to 7 μ A, no electrolysis, pulses have a biphasic shape) and few side effects. It can be applied in two ways: either with a handheld applicator (oscillating head) or with the therapist's hands (vinyl gloves are used), which are connected to the device. It is recommended to combine different modalities (variable frequency 100–144 Hz; constant frequency 85 Hz; variable frequency 14–20 Hz), which provide different mechanisms for overcoming symptoms (47). Therapeutic exercises are performed immediately after Deep Oscillation® therapy. The kinesitherapy session includes: aerobic exercises; open-chain thigh muscle exercises (38); relaxing exercises for muscles in spasm, moderate resistance exercises, exercises to increase range of motion, and training for everyday activities. The application of an electrostatic field makes it possible to control pain and swelling, and to modulate and reduce inflammation (48). The combined application of mechanical and electrostatic effects optimizes blood and lymph circulation and has a positive effect on the mechanical properties of the muscles. There are reports from studies that show effective

reduction of pain and inflammation, reduction of swelling, and increased range of motion in the joints (47, 48). Better results are achieved in terms of the timing and degree of recovery of joint function (51). Recent studies recommend that therapeutic exercise programs include exercises for the torso and abdominal muscles (34, 38, 52). Improving muscle activity and reducing muscle imbalance leads to maintaining joint mobility, stability, and function (53).

Exercises, combined with regular physical activity, prevent the onset of inactivity-related hypotrophy or contractures. They are able to activate descending mechanisms for pain modulation and control, and can also have a positive effect on improving the patient's emotional tone (54). On the other hand, precise dosing of physical activity and training is required, as there are reports that high, sudden, and/or excessive physical activity can exacerbate OA (55-57). Nevertheless, there is evidence that regular exercise has a long-term effect in terms of pain reduction after physical exercise (58).

According to the latest recommendations, physical activity and regular exercise improve tissue sensitivity to insulin, facilitate weight control, and have a positive effect on the cardiovascular system (59). Oxygen consumption increases up to 20 times during physical activity. Skeletal muscles accelerate the use of available glycogen, triglycerides, and free fatty acids. At the same time, the heart works under better conditions due to reduced peripheral vascular resistance, which is a result of skeletal muscle activation. That leads to more effective control of peripheral blood vessel tone, which can play a good preventive role in terms of diabetes, cardiovascular health, and the central nervous system (60, 61).

In elderly people, as they age, their functional activity is often limited by changes in the musculoskeletal system, accompanied by joint pain, stiffness, and slow gait (62). Measured walking is recommended (63), for which there is evidence in older women that there is a link between a reduced risk of CVD and fewer episodes of hypokinesia and reduced physical activity (64).

Rehabilitation in CVD is an important therapeutic intervention aimed at optimal functional recovery and prevention of possible

new acute cardiovascular events. Rehabilitation is a key factor in recovery and maintaining health. It includes various strategies, such as psychological support, lifestyle changes, proper nutrition, risk factor control, physical activity, and therapeutic exercises (65). The implementation of rehabilitation measures in CVD has a proven clinical effect in patients who have undergone cardiovascular surgery, atrial fibrillation, myocardial infarction, and/or heart failure. It leads to improved functional activity and physical fitness and, in addition, it has been proven to reduce fatal incidents in these patients (66, 67).

CONCLUSION

The possible influence of osteoarthritis in the onset and progression of cardiovascular disease is an issue that has been the focus of attention in recent years. Due to the presence of common risk factors and common mechanisms in the pathogenesis of these diseases, research continues into the potential therapeutic effects of applying physical factors to prevent and control their progression. Physical activity and regular exercise have a number of benefits for the prevention, treatment, and rehabilitation of cardiovascular and degenerative joint diseases. It is important to adequately assess, according to the individual characteristics of the patient (age, stage of the disease, comorbidity, baseline level of physical activity and physical fitness), the type of physical activity and exercises that are appropriate at the specific moment of prescribing rehabilitation interventions. Due to the presence of not yet fully clarified interrelationships and mechanisms of interaction, it is necessary to continue researching this area in the future.

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