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ASSESSMENT OF ATHEROSCLEROSIS IN PATIENTS WITH OSTEOARTHRITIS USING VASCULAR DOPPLER ULTRASOUND

Ganieva N. A.
Uzoqov J. E.
Tashkent State Medical University

Abstract

This article analyzes the characteristics of atherosclerosis development in patients with osteoarthritis and the possibilities for its early detection using vascular Doppler ultrasound. According to contemporary scientific data, osteoarthritis is no longer considered solely a degenerative joint disease but is increasingly recognized as a systemic pathology associated with chronic low-grade inflammation. These inflammatory processes contribute to the development of atherosclerosis through endothelial dysfunction, disturbances in lipid metabolism, and metabolic alterations. The study examines the pathogenetic relationship between osteoarthritis and atherosclerosis, as well as key cardiovascular risk factors. The diagnostic value of vascular Doppler ultrasound in detecting subclinical atherosclerosis is highlighted, including its principal indicators such as intima–media thickness, atherosclerotic plaques, and hemodynamic changes. Analysis of current studies indicates that increased intima–media thickness, vascular structural alterations, and impaired blood flow are frequently observed in patients with osteoarthritis. Additionally, age, inflammation, dyslipidemia, and physical inactivity are identified as significant contributors to cardiovascular risk formation. The noninvasive, safe, and highly informative nature of Doppler ultrasonography supports its widespread application in clinical practice. The use of pie charts in the article allows for a clear visualization of the relative contribution of various factors. In conclusion, early detection and prevention of atherosclerosis in patients with osteoarthritis play a crucial role in reducing cardiovascular complications.

Keywords: Osteoarthritis, atherosclerosis, Doppler ultrasonography, intima–media thickness, subclinical atherosclerosis, cardiovascular risk, inflammation, dyslipidemia, endothelial dysfunction, physical inactivity.

Introduction

Osteoarthritis is one of the most common degenerative diseases in modern medicine, and recent scientific studies have demonstrated that it is not limited to joint involvement but is also associated with systemic pathological changes occurring throughout the body. The growing prevalence of this condition, driven by population aging, physical inactivity, obesity, and the widespread occurrence of metabolic syndrome, has made it a significant global healthcare challenge. At the same time, the high incidence of cardiovascular diseases among patients with osteoarthritis indicates that this condition should not be regarded solely as a rheumatologic disorder, but rather as a multisystem disease characterized by involvement of multiple organs [2,3]. Atherosclerosis remains one of the leading causes of mortality and disability worldwide, and early detection of its subclinical stages is essential for improving prevention and treatment outcomes. In this context, the early identification of atherosclerosis in patients with osteoarthritis

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is of particular importance, and vascular Doppler ultrasound represents one of the most informative and noninvasive diagnostic methods available [1,7].

The relationship between osteoarthritis and atherosclerosis is based on complex and multifactorial pathogenetic mechanisms. Chronic low-grade inflammation observed in osteoarthritis is mediated by cytokines such as interleukins, tumor necrosis factor, and C-reactive protein. These inflammatory mediators impair endothelial function, reducing its vasoregulatory and antithrombotic properties [5,13]. As a result of endothelial dysfunction, lipid infiltration into the vascular wall increases, oxidative processes are activated, and favorable conditions are created for the formation of atherosclerotic plaques. In addition, metabolic disturbances such as dyslipidemia, insulin resistance, and abdominal obesity are frequently observed in patients with osteoarthritis, further accelerating the process of atherogenesis [6,11]. The combined effect of these factors leads to a significantly higher cardiovascular risk in osteoarthritis patients compared to the general population.

Below are presented data reflecting the relative contribution of various factors involved in the development of atherosclerosis in patients with osteoarthritis. This distribution is based on an analysis of contemporary scientific sources. The main contributing factors include systemic inflammation, dyslipidemia, obesity and metabolic syndrome, as well as reduced physical activity.

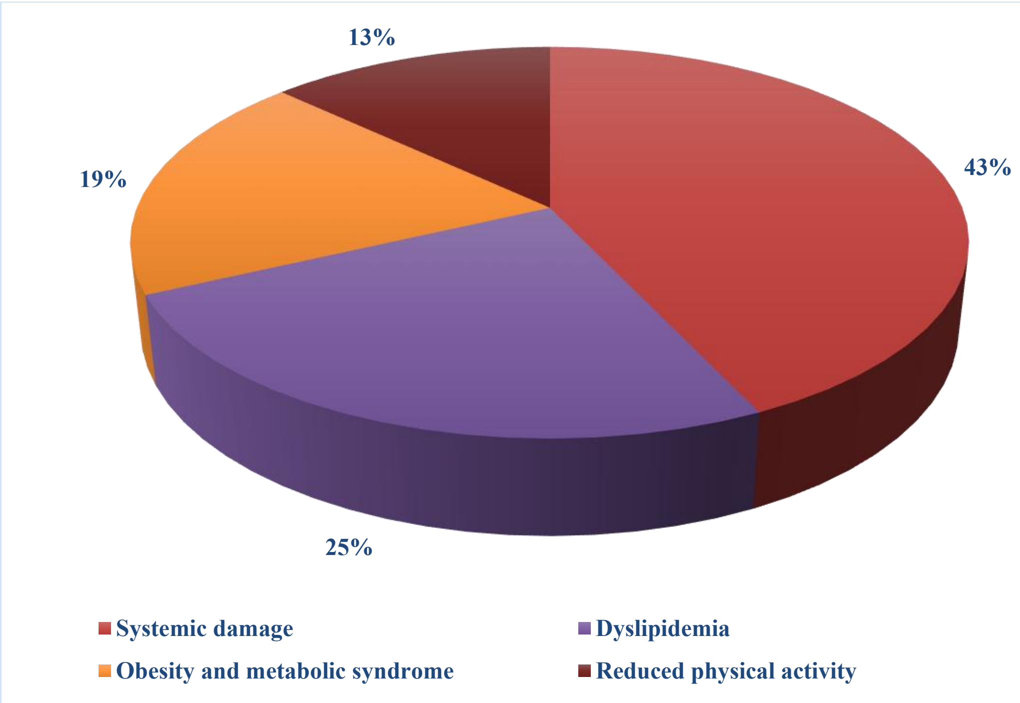

Figure 1. Distribution of factors contributing to atherosclerosis development in patients with osteoarthritis

This diagram visually represents the relative contribution of various pathogenetic factors involved in the development of atherosclerosis in patients with osteoarthritis. The largest proportion corresponds to systemic inflammation, clearly demonstrating its predominance over other contributing factors. This finding highlights the central role of the inflammatory component of osteoarthritis in the process of atherogenesis. Dyslipidemia occupies the second

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largest share, emphasizing the significance of lipid metabolism disorders in the development of vascular pathology. The portion attributed to obesity and metabolic syndrome reflects the contribution of systemic metabolic disturbances to the progression of atherosclerosis. Although the share related to reduced physical activity is comparatively smaller, its importance remains considerable, as physical inactivity is one of the key contributors to metabolic and hemodynamic abnormalities. The relative size of each segment of the diagram clearly demonstrates the interrelationship and hierarchy of these contributing factors [4,17].

Vascular Doppler ultrasound is considered a highly informative method for the detection of subclinical atherosclerosis. This technique allows for the assessment of intima–media thickness, vascular wall structure, and blood flow characteristics. An increase in intima–media thickness is regarded as one of the earliest indicators of atherosclerosis and can be detected even before the appearance of clinical symptoms [8,19]. In addition, Doppler ultrasonography enables the evaluation of atherosclerotic plaques, the degree of stenosis, and hemodynamic changes.

Analysis of Doppler ultrasound findings in patients with osteoarthritis demonstrates a high prevalence of subclinical atherosclerosis in this population. In particular, increased intima–media thickness is the most frequently observed abnormality [12,15]. Furthermore, the formation of atherosclerotic plaques and alterations in blood flow parameters are also commonly identified. These findings are presented more clearly in the following diagram.

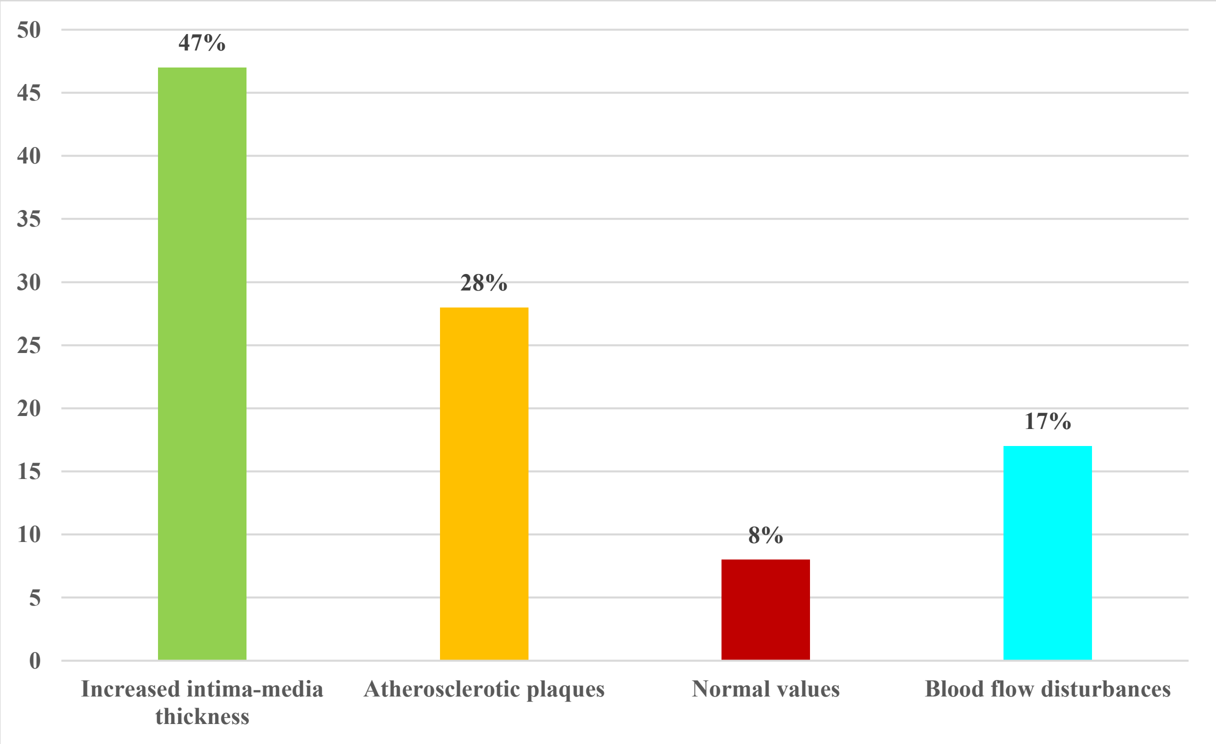

Figure 2. Changes observed in doppler examination in patients with osteoarthritis

Analysis of the Doppler examination results illustrates the relative distribution of detected vascular alterations. In the diagram, an increase in intima-media thickness occupies the largest share, representing the most common marker of subclinical atherosclerosis, observed in 47% of cases. The presence of atherosclerotic plaques detected on Doppler indicates morphological changes in the vascular wall and was found in 28% of patients. This finding reflects the existence of hemodynamic disturbances related to impaired blood flow. Normal findings were relatively

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rare, accounting for only 8%, while blood flow disturbances were identified in 17% of osteoarthritis patients, confirming the high frequency of vascular abnormalities in this population.

The development of cardiovascular risk in patients with osteoarthritis is a multifactorial process. Factors such as age, genetic predisposition, inflammation, lipid metabolism disorders, and lifestyle play a significant role in this process. Osteoarthritis is accompanied by pain syndrome and limited mobility, which lead to reduced physical activity. As a result, obesity, metabolic syndrome, and dyslipidemia often develop, further increasing the risk of atherosclerosis. The relative contribution of these factors is illustrated in the following diagram.

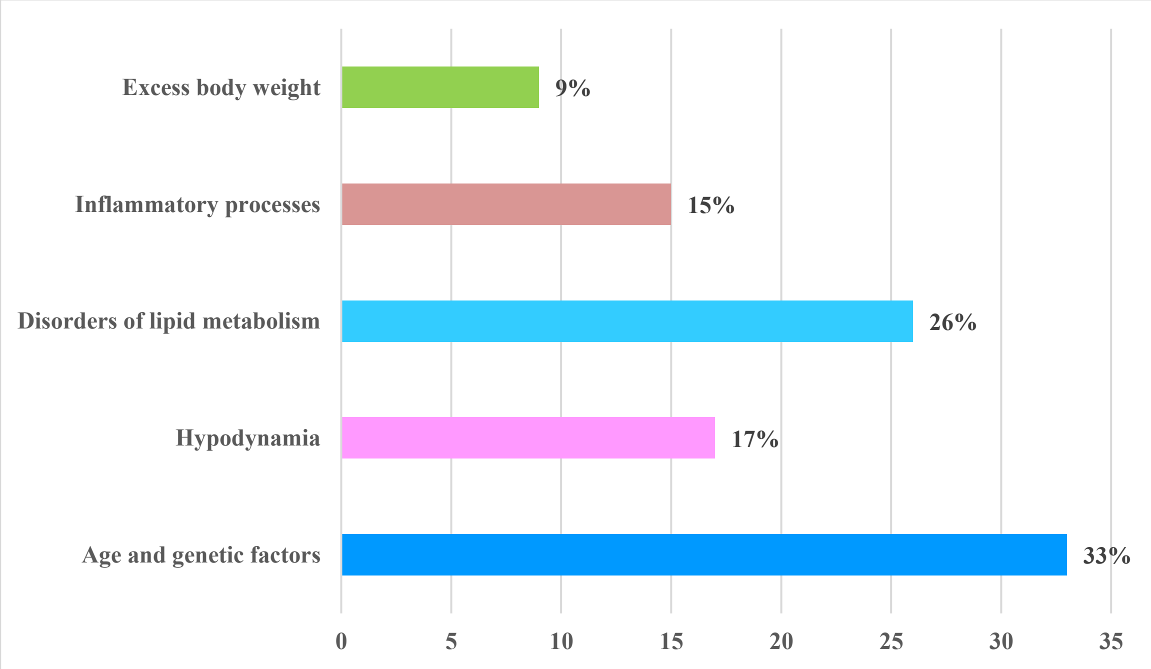

Figure 3. Distribution of cardiovascular risk factors in patients with osteoarthritis

According to published data, this diagram illustrates the relative contribution of factors involved in the development of cardiovascular risk and demonstrates their interrelationships. Age and genetic factors account for 33%, occupying the leading position in disease progression. Disorders of lipid metabolism occupy the second place with a 26% share and represent a significant pathogenic factor in atherosclerosis development. Physical inactivity (hypodynamia) constitutes 17%, negatively affecting overall metabolic status through reduced physical activity. Inflammatory processes account for 15%, contributing to atherogenesis via endothelial dysfunction. Although excess body weight represents a smaller share (9%) compared to other factors, it remains an important contributor to cardiovascular risk when combined with the aforementioned factors.

Analysis of the relationship between osteoarthritis and atherosclerosis indicates that osteoarthritis should be considered not only as a rheumatologic disease but also as a cardiovascular risk factor. This necessitates a comprehensive approach in clinical practice. Patient evaluation should include not only joint status but also assessment of the vascular system. The application of Doppler examination enables early detection of subclinical atherosclerosis, allowing timely implementation of preventive measures.

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From a therapeutic perspective, reducing atherosclerosis risk in patients with osteoarthritis requires a multifaceted approach. Normalizing lipid metabolism, reducing inflammation, increasing physical activity, and ensuring proper nutrition are of critical importance. Additionally, individualized treatment strategies can be developed based on Doppler findings, which is effective in preventing cardiovascular complications.

In conclusion, patients with osteoarthritis have a high likelihood of developing atherosclerosis, which is associated with inflammation, endothelial dysfunction, and metabolic disturbances. Vascular Doppler examination is a reliable and effective method for early detection of these changes. Visual representation of data through circular diagrams enhances the quality of scientific publications and facilitates interpretation of results. This approach, when widely applied in clinical practice, contributes to reducing cardiovascular complications in patients with osteoarthritis.

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