



Article

The Effect of Metabolic Control on Reducing Disability in Rheumatoid Arthritis Patients With Diabetes Mellitus

Bafayev J.T.¹

1. Bukhara State Medical Institute

* Correspondence: bafayev.jamshed@bsmi.uz

Abstract: Diabetes mellitus and rheumatic diseases are among the most prevalent chronic conditions worldwide, often coexisting and compounding each other's clinical outcomes. Research has increasingly indicated a bidirectional relationship between metabolic disorders and inflammatory joint diseases, yet their intertwined pathophysiology and impact on disability remain insufficiently addressed in clinical management strategies. While individual treatment protocols exist for each condition, there is a lack of integrated approaches targeting patients with comorbid diabetes and rheumatoid arthritis. This study aims to explore the influence of metabolic control—particularly blood glucose regulation—on the progression and disability outcomes in patients suffering simultaneously from diabetes mellitus and rheumatoid arthritis. Analysis of clinical studies and literature revealed that up to 42% of diabetic patients may develop arthritis, and conversely, rheumatoid arthritis increases the risk of type 2 diabetes by 1.2–1.4 times. Shared risk factors such as obesity, sedentary lifestyle, chronic inflammation, and corticosteroid use exacerbate both conditions. The study confirms that improved metabolic control reduces inflammatory activity, preserves joint function, and mitigates the risk of systemic complications. This research presents a multidisciplinary synthesis linking endocrinology and rheumatology, emphasizing metabolic regulation as a central mechanism in preventing disability progression. The findings advocate for comprehensive treatment strategies that prioritize glycemic control, weight management, and anti-inflammatory interventions, offering practical recommendations to enhance patient quality of life and reduce long-term healthcare burden.

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1. Introduction

The relevance of the topic of the relationship between diabetes and rheumatic diseases is that both of these diseases are highly prevalent and have serious health consequences[1]. Modern research shows that the presence of diabetes, especially in its long-term or severe form, significantly increases the risk of developing rheumatic diseases, and also aggravates their course. In turn, the presence of joint inflammation and other manifestations of autoimmune diseases can contribute to the progression of metabolic disorders, such as insulin resistance, which increases the risk of developing diabetes[2]. This problem is especially relevant in light of the global increase in the number of people with diabetes, as well as the increase in the incidence of various chronic inflammatory diseases, such as arthritis and other autoimmune disorders. The combined effects of these diseases on the

body require a comprehensive approach to treatment, as well as the need to develop effective preventive measures[3].

In addition, both diseases - diabetes and rheumatic diseases - have similar risk factors, such as excess body weight, physical inactivity, chronic inflammation and metabolic disorders. In this regard, it is important to develop new treatment and rehabilitation strategies aimed at eliminating not only the symptoms, but also preventing mutual deterioration of the patient's condition[4]. Thus, studying the relationship between diabetes and rheumatic diseases helps to raise awareness among physicians and patients about the need for an integrated approach to the treatment of these conditions, which in turn helps to reduce morbidity and improve the quality of life of patients.[5].

2. Materials and Methods

To achieve the aim of the study, a systematic review of scientific publications was conducted, as well as an analysis of clinical research data on the relationship between diabetes mellitus and rheumatic diseases. The sources used were articles published in international medical journals over the past 5 years, as well as data from the World Health Organization (WHO) and other authoritative medical institutions[6].

The following methods were used in the work:

1. Analysis of scientific literature - to study existing theories and approaches to the relationship between diabetes mellitus and rheumatic diseases, as well as to identify the mechanisms of their interaction. Meta-analyses and clinical studies covering the influence of hyperglycemia, insulin resistance and inflammation on the development and course of diseases were analyzed[7].
2. Clinical studies - the results of clinical studies aimed at studying the mutual influence of diabetes and inflammatory joint diseases, such as rheumatoid arthritis and psoriatic arthritis, are reviewed. Evaluation of clinical observations data allowed us to identify common pathogenetic mechanisms and risk factors, such as excess body weight, hyperglycemia and microcirculation disorders.
3. The meta-analysis method was used to summarize and analyze the results of various studies, which made it possible to identify the main trends and patterns in relation to the relationship between diabetes mellitus and rheumatic diseases.
4. Review of clinical guidelines - based on existing guidelines and treatment protocols, an understanding of a comprehensive approach to the treatment of patients with diabetes mellitus and concomitant rheumatic diseases was formulated, and the basic principles of prevention and rehabilitation of such patients were identified[8].

Thus, the study is based on a comprehensive approach, including analysis of existing literature data, clinical studies and meta-analysis, which made it possible to assess the relationship between diabetes mellitus and rheumatic diseases and develop recommendations for effective treatment and prevention of these conditions.

3. Results and Discussion

According to the results of the studies, arthritis, including autoimmune forms, is diagnosed in 42% of patients with diabetes mellitus. In particular, with rheumatoid arthritis, the likelihood of developing diabetes increases by 1.2–1.4 times .

A study published in 2018 showed that people with psoriasis and psoriatic arthritis develop type 2 diabetes significantly more often. According to scientists, even newly diagnosed psoriasis can disrupt metabolism. Therefore, patients with this diagnosis are advised to monitor not only the condition of their joints and skin, but also blood pressure, weight, and blood glucose levels [9].

The development of diabetes in rheumatic diseases is a complex and multifaceted process, and at the moment scientists have not been able to identify the exact causes of this phenomenon. However, there are a number of hypotheses that explain the connection between these two conditions. One of these factors is excess weight, which often

accompanies people with inflammatory diseases of the joints. Excess body weight contributes to metabolic disorders, which increases the risk of diabetes.

In addition, a sedentary lifestyle, which is often observed in patients with rheumatic diseases due to pain and limitations in movement, can also be the cause of deterioration of metabolism and increased blood sugar levels. An important factor is the activity of inflammation in the joints. Chronic inflammation, which is characteristic of diseases such as osteoarthritis or rheumatoid arthritis, can affect the functioning of various body systems, including the endocrine system, which in turn increases the likelihood of developing diabetes[10].

It is also worth noting that some drugs used to treat rheumatic diseases can have side effects that contribute to increased blood sugar levels. For example, corticosteroids, which are often prescribed for inflammatory diseases, can disrupt the normal functioning of insulin and increase glucose levels. Thus, the combination of these factors - excess weight, inactivity, chronic inflammation and drug treatment - can play an important role in the development of diabetes in patients with rheumatic diseases.

Normal health indicators include a body mass index (BMI) of 18.5 to 25, which is calculated as the ratio of body weight in kilograms to the square of height in meters. Blood pressure should be between 110/70 and 129/85 mmHg, which means systolic pressure from 110 to 129 mmHg and diastolic pressure from 70 to 85 mmHg. It is also important to maintain fasting blood glucose levels between 3.3 and 5.5 mmol / L, which is considered normal for a healthy body. These indicators serve as a guideline for assessing overall health.

Clinical studies show that more than 50% of patients suffering from both diabetes and arthritis are overweight (BMI over 25) or obese (BMI over 30) . These data indicate a significant link between weight and the development of chronic diseases such as diabetes and arthritis[11].

To understand what excess weight is, it is worth considering the body mass index (BMI) - one of the most objective indicators. BMI is calculated using the formula: weight in kilograms divided by the square of height in meters. For example, with a height of 175 cm and a weight of 80 kg, the BMI will be 26.1, which corresponds to the category of excess weight. According to the recommendations of the World Health Organization (WHO), normal BMI values are within 18.5–25 .

The connection between excess weight and autoimmune diseases, including arthritis, has been studied for many years. It has now been scientifically proven that adipose tissue is not just an energy reserve, but an active endocrine organ that produces various hormones and mediators. These substances affect many physiological processes in the body, including metabolism, the immune system, and inflammatory reactions .

It is especially important that the hormones and mediators produced by adipose tissue have a pronounced pro-inflammatory effect. One such substance is tumor necrosis factor alpha (TNF-alpha), which binds to insulin receptors in fat cells. This inhibits insulin activity, which in turn contributes to the development of insulin resistance . In this state, cells lose sensitivity to insulin, which leads to an increase in blood glucose levels [12].

Excess weight is not only an aesthetic discomfort, but also a serious medical problem. Excess adipose tissue is one of the main risk factors for the development of type 2 diabetes. Visceral obesity, in which fat is deposited on the abdomen and around the internal organs, is especially dangerous. This creates favorable conditions for the development of diabetes and can contribute to its rapid progression. Moreover, people with diabetes find it much more difficult to lose weight than healthy people, even when following a diet and physical activity .

Many patients with rheumatic diseases experience limited mobility, which is largely due to chronic joint pain and dysfunction. These pains and limitations in movement become a serious obstacle to physical activity, which in turn leads to hypodynamia - a condition in which physical activity is significantly reduced. The forced reduction in

physical activity contributes to excess weight gain, which is one of the key problems for such patients[13].

Excess body weight has a negative impact on metabolism. In particular, with the accumulation of adipose tissue, the body's cells lose their sensitivity to insulin. Insulin is a hormone responsible for transporting glucose into cells, where it is used as an energy source. When cells become resistant to insulin, this process is disrupted and glucose cannot be effectively absorbed. As a result, blood glucose levels rise because it does not enter the cells, remaining in the blood serum. This condition is called insulin resistance and is a precursor to the development of type 2 diabetes. If insulin resistance is not controlled, it can eventually lead to the development of diabetes, which increases health risks and complicates the course of other diseases, such as arthritis .

Observations show that the more intense the inflammatory process in rheumatic diseases, the higher the probability of the patient developing various concomitant diseases and conditions. Using rheumatoid arthritis, one of the most common inflammatory diseases of the joints, as an example, it was found that inflammation in the joints increases the risk of metabolic syndrome, obesity, atherosclerosis, cardiovascular diseases, and diabetes. This is explained by the fact that systemic inflammation affects not only the joints, but also other tissues and organs, disrupting their normal functioning.

There is an opinion that the connection between inflammation and the development of these diseases may be related to genetic predispositions. Research shows that different variants of genes that regulate the production of substances that promote inflammation may play a key role in the development of these pathologies. Thus, the inflammatory process in rheumatoid arthritis may not only be localized in the joints, but also have a systemic effect, which contributes to the development of many metabolic and cardiovascular diseases .

In addition, it is known that the higher the inflammation activity in rheumatoid arthritis, the more pronounced the risk of developing metabolic disorders, including diabetes. In turn, in patients who already suffer from metabolic disorders, the course of rheumatoid arthritis is usually more severe. Metabolic disorders can worsen inflammation in the joints, which makes the disease more persistent and difficult to treat, creating a vicious circle where each condition intensifies the other [14].

Treatment of rheumatic diseases often includes the use of glucocorticosteroids - drugs that effectively relieve inflammation, swelling and pain in the affected joints. These drugs can be prescribed both systemically (in the form of tablets or injections) and locally, for example, in the form of intra-articular injections for direct action on the inflamed joint. However, despite their effectiveness, glucocorticosteroids have serious side effects, especially with long-term use and in high doses.

One of the main side effects of glucocorticosteroids is their impact on the entire body, not just on the inflammatory process in the joints. One of these effects is an increase in blood glucose levels. This is due to the fact that glucocorticosteroids can disrupt the normal functioning of insulin, which leads to the development of insulin resistance . With insulin resistance, the body's cells lose the ability to respond to insulin, and blood glucose levels increase. This, in turn, can lead to the development of diabetes mellitus, which is a serious side effect with long-term use of these drugs .

Long-term or severe diabetes can lead to damage to the musculoskeletal system, and this process often develops in a similar way to how joint damage occurs in autoimmune diseases. The causes of this process are varied, and among them, both genetic predisposition and disorders associated with high blood sugar levels play an important role.

Diabetes mellitus itself creates favorable conditions for the development of rheumatic diseases, especially in people with an unfavorable family history. When a patient's immediate relatives had diseases such as rheumatoid arthritis or psoriatic arthritis, the risk

of developing such diseases in the patient himself increases, especially if he has already been diagnosed with diabetes mellitus.

One of the main factors affecting joint health in diabetes is hyperglycemia - high blood glucose levels. Constantly elevated sugar levels contribute to the accumulation of advanced glycation end products - molecules that form as a result of the reaction of glucose with proteins. These products have the ability to "cross-link" collagen threads, which play an important role in ensuring the strength and flexibility of joints. As a result of this process, collagen in the joint tissues becomes less elastic, which disrupts the structure of the cartilage. Cartilage loses its ability to stretch and recover normally, which in turn complicates the restoration of damaged tissues and contributes to the development of inflammatory processes.

In addition, diabetes mellitus disrupts microcirculation, which leads to deterioration of blood supply to the joints. Hypoxia occurs in the joint tissues - a lack of oxygen, which causes an increase in the level of free radicals and contributes to the destruction of cells. Lack of oxygen and deterioration of tissue nutrition accelerates the degradation of cartilage, and also triggers inflammatory processes. Collagen, which connects the tissues of the joints, is produced in insufficient quantities, which only aggravates the destruction and leads to the development of arthritis[15].

In addition, high glucose levels can have a destructive effect on nerve fibers, which leads to a disruption of innervation. As a result, nerves become less sensitive to signals from the body, and patients with diabetes often do not notice the overload of the joints, which contributes to their wear and tear. Gradually, this leads to the development of arthritis and other joint problems, since excessive stress on the joints accelerates their destruction.

Excess body weight, which is also often found in people with diabetes, only worsens the situation. Excess weight increases the load on the joints, which creates additional conditions for the development of joint diseases and accelerates the progression of existing pathologies.

Another significant factor is chronic inflammation, which is often observed in people with diabetes. Cytokines produced in adipose tissue activate inflammatory processes and create a predisposition to the development of autoimmune diseases. This inflammation can affect not only the joints, but also other organs, increasing general disorders in the body.

Thus, for effective treatment of rheumatic manifestations in diabetes, special attention should be paid to blood glucose control. Reducing and stabilizing sugar can significantly slow down the development of inflammatory processes and prevent the progression of joint diseases. In addition, this will help reduce the risk of complications associated with diabetes and improve the quality of life of patients.

4. Conclusion

Diabetes mellitus, especially in its long-term and severe course, significantly affects joint health, causing or aggravating various rheumatic diseases. This process occurs due to several interconnected mechanisms, such as genetic predisposition, hyperglycemia, impaired microcirculation and innervation, as well as excessive load on the joints due to excess weight. All these factors lead to deterioration of the structure of joint tissues, destruction of cartilage and development of inflammation. The key point in the treatment of rheumatic manifestations in diabetes mellitus is control of blood glucose levels, which can slow down the progression of diseases and prevent their complications.

Practical recommendations for patients with diabetes mellitus suffering from rheumatic diseases include the following key points. The main priority in treatment is to maintain stable blood sugar levels. Regular glucose monitoring and adherence to prescribed therapy will help to avoid the development of insulin resistance and prevent the progression of metabolic disorders and joint inflammation. The use of drugs for sugar

control, including insulin and hypoglycemic agents, should be adapted to the individual needs of the patient.

Reducing excess weight and maintaining it within normal limits are important aspects of treatment. This reduces the load on joints, reduces the risk of diabetic complications and contributes to improving overall health. For this, a combination of diet therapy and regular physical activity is recommended.

Moderate exercise can help strengthen muscles, maintain joint flexibility, and improve overall health. For patients with rheumatic diseases, it is important to choose activities that do not put stress on joints (e.g., swimming, yoga, stretching exercises). Regular exercise also helps improve insulin sensitivity.

Both medications (e.g. nonsteroidal anti-inflammatory drugs, glucocorticosteroids) and non-medicinal approaches such as physical therapy, heat and cold compresses, and massage can be used to reduce joint pain and inflammation. It is important to consult with your doctor about the most appropriate treatment methods to avoid side effects associated with long-term drug use.

Patients with diabetes and rheumatic diseases should regularly check their blood pressure, cholesterol levels, and other metabolic parameters. High blood pressure and elevated cholesterol levels can worsen the course of both diabetes and inflammatory diseases.

Because of the increased risk of osteoporosis with long-term use of glucocorticosteroids , patients are advised to have regular bone health checks and to eat a diet rich in calcium and vitamin D. Drugs that improve bone density may be recommended to prevent osteoporosis.

Patients should visit specialists regularly to monitor the condition of their joints, blood sugar levels, and to assess possible complications such as cardiovascular disease and kidney damage. Timely diagnosis and treatment adjustments can help avoid serious complications.

These recommendations will help reduce health risks and improve the quality of life of patients suffering from diabetes and rheumatic diseases.

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