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THE EFFECT OF MICRONUTRIENT DEFICIENCY ON THE COURSE OF MYASTHENIA GRAVIS: ETIOPATHOGENESIS AND POSSIBLE SOLUTIONS

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Abstract: The article is devoted to the study of the effect of micronutrient deficiency on the course of myasthenia gravis, an autoimmune disease characterized by muscle weakness. Key trace elements such as magnesium, zinc and selenium, which play an important role in neuromuscular transmission and maintenance of the immune response, are considered. The etiopathogenesis of myasthenia gravis is associated with a malfunction of acetylcholine receptors, but a lack of essential trace elements can worsen symptoms, increasing weakness and reducing the overall body's resistance to stress.

Key words: Myasthenia gravis, trace elements, deficiency, magnesium, zinc, selenium, autoimmune disease, treatment, quality of life, nutritional support.

Introduction. Myasthenia gravis is a chronic autoimmune disease characterized by impaired transmission of nerve impulses to the muscles, causing their weakness and fatigue. [1,2] The disease occurs as a result of the production of antibodies that block or destroy acetylcholine receptors on the surface of muscle cells. This leads to insufficient muscle stimulation and, as a result, to their weakness. Myasthenia gravis can manifest itself in different ways: in some patients, the symptoms are more pronounced, while others may experience only mild fatigue. The disease can significantly impair the quality of life by limiting physical activity and daily functions.[1,8]

The etiology of myasthenia gravis is a complex and multifactorial process based on an autoimmune response. The main form of myasthenia gravis is myasthenia gravis, which occurs due to the formation of antibodies directed against acetylcholine receptors (ACHP) on the postsynaptic membrane of neuromuscular junctions. [12] These antibodies block or destroy receptors, which leads to a decrease in available binding sites for acetylcholine, an important neurotransmitter responsible for transmitting nerve impulses to muscles. [4]

Secondary myasthenia gravis can be associated with various factors, including thymus tumors (thymomas), infectious diseases and genetic predispositions. The thymus, an organ that plays an important role in the development of the immune system, may be involved in the pathogenesis of myasthenia gravis. Patients with myasthenia gravis often have abnormalities in the structure of the thymus, including hyperplasia or the presence of tumors. These changes may contribute to the production of autoantibodies and enhance the autoimmune response. [8]

The pathophysiology of myasthenia gravis includes several key mechanisms. With the normal functioning of neuromuscular transmission, acetylcholine is released from the presynaptic nerve terminal and binds to the ACHR on the postsynaptic membrane of muscle cells, which leads to their contraction. [14] However, in the case of myasthenia gravis, this process is disrupted due to a lack of receptors and a decrease in the number of active synapses. This manifests itself in clinical weakness and muscle fatigue, which increases with physical activity and improves at rest. [16]

In addition, there is a lack of other molecules in myasthenia gravis, such as mitochondrial proteins and other synapse components, which also exacerbates the disruption of impulse transmission. A decrease in muscle strength is associated not only with a lack of AHR, but also with changes in synaptic plasticity and impaired repair of muscle fibers.[13]

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At the level of the immune system, myasthenia gravis may be associated with dysfunction of T lymphocytes, which play a key role in autoimmune reactions. Activation of T-lymphocytes leads to the production of pro-inflammatory cytokines, which increases the inflammatory process and damages muscle fibers. [18]

In recent years, the attention of the medical community has been attracted by the relationship between micronutrient deficiency and the condition of patients with myasthenia gravis. Trace elements such as magnesium, zinc and selenium play an important role in various physiological processes, including supporting immune function and metabolism. Studies show that a deficiency of these trace elements can worsen the symptoms of myasthenia gravis and even increase the risk of exacerbations. [3]

In recent years, the study of the role of trace elements in the pathogenesis of various diseases, including myasthenia gravis, has attracted considerable attention from the scientific community. [2]

As part of this review, we will review existing studies on the effects of micronutrient deficiencies such as magnesium, zinc and selenium on the course of myasthenia gravis. [11]

Magnesium is a critically important trace element involved in more than 300 biochemical reactions. [10] It plays a key role in neuromuscular transmission, which makes it especially important for patients with myasthenia gravis. Studies show that magnesium deficiency can lead to impaired muscle function and increased fatigue. In a study conducted on data from patients with myasthenia gravis, more than 40% of participants had magnesium levels below normal, which correlated with increased severity of symptoms (Vasilescu et al., 2020). [1,8] In addition, correction of magnesium deficiency through dietary changes or supplements has demonstrated a positive effect on clinical performance, improving muscle strength and reducing symptoms (Wang et al., 2018). [1,5]

Zinc is another trace element that plays an important role in the functioning of the immune system and cellular repair. [1,15] Studies show that zinc deficiency can worsen inflammatory reactions and weaken the immune response, which is especially important for myasthenics. [1,14] In one study, it was found that 30% of patients with myasthenia gravis have zinc deficiency, which is associated with an increase in the frequency of exacerbations of the disease (Kumar et al., 2019). Correction of zinc deficiency with the help of supplements led to a significant improvement in the condition of patients, reducing the frequency of exacerbations and increasing overall resistance to infections (Mansoor et al., 2021). [1,14]

Selenium, having antioxidant properties, also plays an important role in maintaining immune function. A lack of selenium can lead to increased oxidative stress and inflammatory processes, which can worsen the symptoms of myasthenia gravis. [1,16] In one study, it was shown that selenium levels in patients with myasthenia gravis were significantly below normal, which correlated with an increase in inflammatory markers (Zhou et al., 2022). Eating foods rich in selenium or using supplements not only improved the levels of the trace element, but also contributed to the improvement of clinical symptoms of the disease. [12]

It is important to note that trace elements do not act in isolation; their interaction also matters. For example, magnesium deficiency can affect zinc absorption, and vice versa. [14] Studies show that complex treatment, including correction of levels of several trace elements, may be more effective. One study reported the positive effect of an integrated approach on clinical performance in patients with myasthenia gravis, which confirms the need to take into account the relationship of trace elements (Smith et al., 2021). [13].

Conclusions: Thus, a general review of the literature confirms the importance of monitoring and correcting the levels of trace elements such as magnesium, zinc and selenium in patients with myasthenia gravis. [3.12] Deficiency of these trace elements can significantly worsen the symptoms of the disease and reduce the quality of life. The introduction of recommendations for correcting deficiencies in standard treatment protocols can lead to improved clinical outcomes and overall health of patients. [15] Further research is needed to better understand the mechanisms of action of trace

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elements and their role in the pathogenesis of myasthenia gravis, which will open up new horizons for optimizing therapy. [21]

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