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Overview of multiple sclerosis (MS) and systemic lupus erythematosus (SLE)

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Abstract

Autoimmune diseases occur as a result of the immune response of the living organism against its own antigens. Some factors may have an effect on the formation of the autoimmune diseases that adversely affect some tissues, organs and systems. In general, the goals of the treatment approaches that should be applied for some autoimmune diseases are to alleviate the symptoms encountered in the development of the disease and to increase the vital functions of the organs and tissues that are affected by the inflammation. Multiple sclerosis (MS) and systemic lupus erythematosus (SLE) diseases are among some common autoimmune diseases. In this review study we will be focusing on both of these diseases.

1. Introduction

The organism's protection against foreign and harmful substances is possible with the immune response. The defense against foreign and harmful substances entering the living organism is carried out by the cells and molecules of the immune system. This protective response created by the organism is described as the immune response [1].

Antigens are molecules that are foreign to the system of the living organism and take part in the production of the immune response. As a result of the immune response, antibody molecules are formed. These antibodies specific to the antigen can bind to neutralize its activities or to eliminate the pathogens associated with the antigens. Antigens show binding with antibodies specific to them. The realization of binding between antigens and antibodies occurs through epitopes, which are also called determinant groups [1-3].

Under normal conditions, the organism does not produce an immune response against its autoantigens, that is, its own structures, and does not start an immune reaction, and this event is characterized as immune tolerance. However, the organism can create an immune response against its own antigens under the influence of some factors, and this leads to the emergence of autoimmune diseases. These factors occur as a result of changes in the chemical or physical properties of the organism's own antigens or immune system cells. In other words, autoimmune diseases occur as a result of impaired immune tolerance [1,4].

There are some factors that trigger the formation of the autoimmune diseases. These factors can be listed as hormonal, immunological, environmental as well as genetic ones [5].

Autoimmune diseases can cause dysfunction and damage to the tissues, as well as adversely affect the body's systems and certain organs [6].

2. MS Disease

Multiple sclerosis (MS) disease affects the central nervous system; it is a chronic, autoimmune and neurological disease characterized by the inflammation. In MS disease, which causes significant cognitive or physical problems, axon, oligodendrocyte and myelin sheath are damaged [7-9].

The axons of the neurons are surrounded by the myelin sheath. In MS disease, the myelin sheath is perceived by some immune system cells as a foreign substance against the body, and during the disease development, the immune system damages the myelin sheath [10].

MS disease is mostly seen in young adults (between 20 and 40 years of age), although it may rarely start at the age of 50 and above, or in childhood. The incidence of MS disease is higher in women than in men [11,12].

2.1. Symptoms of MS Disease

Different parts of the central nervous system can be affected in MS. This results in differences in signs and symptoms among sick individuals. Some of the symptoms seen in MS disease include; speech problems, depression, vision problems, difficulty walking, cognitive impairment, swallowing problems, fatigue, tingling and numbness, attention deficit and respiratory problems [8,9].

Fatigue Problem: Fatigue is among the common symptoms that occur in individuals with MS and prevent them from performing daily activities. Although the cause of the fatigue problem has not been clearly clarified, it is thought that some factors (such as depression, spasticity) affect this situation. Approximately 70% to 95% of individuals with MS have symptoms of fatigue [7, 13-15].

Cognitive Problems: One of the symptoms seen in individuals with MS disease and affecting the quality of life of the individual is cognitive problems. Forgetfulness is one of the cognitive problems seen in MS patients [14].

Speech Problems: Speech problems that occur in individuals with MS disease can be seen together with swallowing problems. Some changes in speech speed and hoarseness are among the speech problems of the patients [14,15].

Walking Problems: Walking problems can be seen in different stages of the MS disease. This situation has a negative effect on the daily activities of the patients [7].

2.2. Risk Factors Affecting the MS Disease

The reason for the development of MS disease remains unclear, but some factors are thought to trigger this condition. In general, among these factors; some autoimmune mechanisms, genetic predisposition, environmental factors, gender and age factor can be counted [8,16].

Deficiency of some vitamins such as B12 and D can be listed among the environmental risk factors that can trigger the development of both MS and some neurological diseases. Epstein-Barr virus (EBV) infection may also be among the environmental risk factors that can trigger the development of the MS disease. The incidence of MS disease is higher in individuals exposed to EBV infection in childhood, adolescence or later, compared to the other individuals who were not exposed to this virus [9,17].

The genetic predisposition factor, which is thought to have an effect on MS disease, is gaining importance day by day. The incidence of MS is higher in first-degree relatives compared to the general population, and in monozygotic twins compared to dizygotic twins. This supports that there is a relationship between genetic factors and the development of MS disease [18].

It is stated that there is a relationship between some human leukocyte antigen (HLA) molecules and MS disease. In other words, it is suggested that HLA molecules play a role among the factors that affect MS development [9,18].

It has been determined that the factors of gender and age also have an effect on the development of MS. The incidence of MS disease is higher in young adults compared to older individuals, and in females compared to the males [8].

Smoking, obesity, radiation, some chemical wastes, race and climatic conditions are among the factors that may directly or indirectly affect the development of MS disease [9,17,19].

2.3. Diagnosis of MS Disease

Demonstrating lesions in the central nervous system becomes the principle of the diagnosis of MS disease. Being able to make an early diagnosis of the disease is very important in terms of choosing the necessary treatment method to be preferred. There is no single diagnostic test for MS disease. Magnetic resonance imaging (MRI) and cerebrospinal fluid analysis help in the diagnosis of the disease. In addition, it is very important to learn about the nutritional habits of individuals, some diseases, if any, and the drugs they use in the diagnosis of MS disease [7-9, 12].

In addition to MRI and cerebrospinal fluid analysis; some other tests such as neurocognitive tests, evoked potentials, blood tests, urodynamic tests, electrophysiology and biopsy are among the tests that help in the diagnosis of MS [7,20].

2.4. Pathophysiology of MS Disease

It has been determined that the immune system is involved in the destruction of both nerve cells and the myelin sheath. In MS; Plaques occur with the loss of axons, inflammation and demyelination. In other words, cells that play a role in the immune system cause damage to the myelin sheath, and thus plaque formation occurs as a result of this situation. Some cells have been identified in the plaques that occur in the MS patients' central nervous system. Among some of the identified cells; B lymphocytes, T lymphocytes, plasma cells, macrophages, microglia cells are included in the development of the disease [8,21-23].

In the pathogenesis of MS, the blood-brain barrier is damaged. As a result of this damage, the permeability of the barrier is impaired. Damage and deterioration of the blood-brain barrier occurs as a result of the formation of lesions in the part of the brain and spinal cord that is described as white matter or white matter [24,25].

MS disease is thought to be mediated by T cells. CD4+ T cells have been detected in both the cerebrospinal fluid and blood of individuals with MS. However, the role of CD4+ T cells in the pathophysiology of the disease has not been clearly defined. In addition, it is known that CD8+ T cells can also be found in the MS lesions and thus play a role in the pathogenesis of MS [9,24].

It is known that Th1 and Th17 cells play a role in the pathogenesis of MS disease. Th1 and Th17 cells differentiate from CD4+ T cells. Some pro-inflammatory cytokines are secreted by Th1 and Th17 cells. Th1 and Th17 cells increase the inflammation that lead into the pathogenesis of MS [26,27].

It is known that B cells, which are involved in the antibody formation, also play a role in the pathogenesis of MS disease. In addition, B cells also have some roles such as producing some cytokines and activating T cells to further contribute the disease development. In this context, B cells may also have an effect on the course of MS disease. The presence of oligoclonal bands in the cerebrospinal fluid and the detection of B cells in MS lesions are among the findings showing that B cells are also involved in the pathogenesis of the MS disease [26-28].

B cells are involved in the secretion of some pro-inflammatory cytokines. This may cause loss of function in neuronal cells. TNF-α, IL-6, IL-12 and IFN-γ are among some of the secreted pro-inflammatory cytokines. B cells can also have positive effects on the central nervous system. These positive effects occur thanks to some anti-inflammatory cytokines they secrete [28].

2.5. Some Treatment Methods in MS Disease

The methods used for the treatment of MS disease are applied for specific purposes. Some of the aims of the applied methods are; increasing physical abilities, relieving symptoms, reducing the frequency and duration of attacks. Currently there is no real treatment method to overcome the disease [20].

2.5.1. Attack Treatment in MS Disease

It is very important to treat the attacks at a level that can increase the quality of life of the patients. These attacks limit their activities and cause functional losses. Reducing the duration of the attacks is among the goals of the attack treatment applied in the MS disease [7,25].

Corticosteroids are frequently used in the treatment of attacks of MS disease. Steroids used in this context have anti-inflammatory effects [25,29].

Plasmapherase administration; it is among the preferred treatment options in cases where corticosteroid treatment is not sufficient and the expected outcome of the corticosteroid treatment is not obtained [29].

2.5.2. Interferon Beta (IFN – β) Treatment in MS Disease

The disease-modifying nature of IFN-β and its immunomodulatory effects make it possible to use this agent in the treatment of the MS disease [12,27,29].

IFN-β has some effects on the MS disease. These effects can be listed as: it reduces the secretion of the pro-inflammatory cytokines and increases the secretion of the anti-inflammatory cytokines, and regulates the activity of the regulatory T cells [7,8,26].

Thanks to some immunological effects of the IFN-β, a decrease in inflammation in the central nervous system and a slowdown in the progression of disability are observed. However, there may be some side effects of IFN-β therapy. These side effects are; appearance of some reactions on the skin, muscle pain, headache, depression, liver problems, fever, itching, anemia, and fatigue [7,12,26,27].

2.5.3. Glatiramer Acetate Treatment in MS Disease

Another treatment approach for MS disease is glatiramer acetate (GA) treatment. In individuals with MS, treatment with glatiramer acetate, an immunomodulatory agent, reduces the recurrence rate and the symptoms that occur. Glatiramer acetate has a mechanism of action that is different from the IFN-β agent and has not been elucidated in details [8,12,27].

Glatiramer acetate treatment may also cause some mild and serious side effects in individuals with MS. Some of the side effects include; some temporary conditions include fever, respiratory problems, digestive problems, palpitations and chest tightness [27,29].

2.5.4. Stem Cell Therapy in MS Disease

While stem cells are used for the purpose of curing and treating some diseases, they are also involved in repairing the damage that occurs in the myelin sheath of the nerve cells. In this context, it is stated that some stem cell types contribute to neurological recovery and prevention of attacks, and also play a role in limiting neuronal damage [7,10,30].

2.5.5. Symptomatic Treatment in MS Disease

It is very important that symptomatic treatments to be applied in individuals with MS disease are preferred in line with the needs of the sick individuals. In addition, in this context, informing the patient about the possible side effects of the treatment and the predicted results for the treatment becomes an important situation. Symptomatic treatment options for MS disease vary according to the symptoms seen in the patient, but in general, they are aimed at increasing the quality of life of the individuals [8,13].

3. SLE Disease

Systemic lupus erythematosus (SLE) disease; is a chronic autoimmune disease that can affect the tissues and organs, cause organ damage, and whose etiology has not been clearly elucidated. It causes damage to the kidneys, skin, nervous system, joints and some organs, this situation is mediated by the immune complexes [31-33].

SLE disease, which can be seen in individuals of all ages, can be seen rarely in childhood. This disease is mostly seen in individuals between the ages of 20 and 40 years [34,35].

It can affect both genders, but is more common in females (mostly during childbearing) compared to the males [33,36,37].

It is thought that many factors have an effect on the occurrence of SLE, that's why different symptoms can occur [37,38].

3.1. Some Symptoms and Findings in SLE Disease

Various symptoms and signs may occur in individuals with SLE disease. Some of the symptoms seen in SLE disease include; kidney disease, some skin findings, neuropsychiatric symptoms, musculoskeletal system involvement, arthritis, headache and muscle pain, weakness, weight changes, fatigue, and fever [36,37,39].

While symptoms such as fatigue, fever and weakness are usually encountered in the early stages of the disease, the symptoms that occur in the organs are usually encountered in the later stages of the disease [31].

Vitamin D deficiency, anxiety, obesity, depression and some factors can be counted among the causes of fatigue problem encountered in SLE [31].

Skin lesions that may occur in SLE may increase with exposure to the sunlight. A rash usually occurs on the cheeks and nose area after the sun exposure [33,40].

Musculoskeletal symptoms are common in individuals with SLE. In this context, arthralgia, myalgia and joint arthritis that affect small or large joints may occur [33,37,39].

Neuropsychiatric symptoms are reported in some individuals with SLE. In this context; conditions such as mood disorders, depression and headaches can be seen [37,39].

Dermatological symptoms can also be seen during the course of SLE. In this direction, some skin rashes and skin lesions may also occur [37].

Kidney disease can be seen in some individuals with the disease. Kidney involvement can be seen in approximately half of the individuals suffering from SLE [36,39].

Cardiovascular effects such as myocarditis, pericarditis and endocarditis and gastrointestinal involvement (with symptoms such as abdominal pain and nausea) can also be observed in SLE patients [33].

3.2. Some Factors That Can Affect the Development of SLE

Although the etiology of SLE is not known with certainty, there are some factors that are thought to be associated with the development of the disease. Among these factors; genetic factors, environmental factors, immunological factors, hormonal factors can be listed as risk factors [33,38].

Presence of the disease in first-degree relatives may increase the probability of SLE disease development in the individual. In other words, it is thought that there is a relationship between genetic predisposition and SLE. It has been suggested that some environmental factors also play a role in the development of the disease. These environmental factors are; some drugs, smoking, stress, ultraviolet rays, some supplements, hormones, some infections, silica exposure, and some foods [32,33,36,40,41].

3.3. Pathogenesis of SLE

Although the etiopathogenesis of SLE has not been clearly elucidated, some factors are thought to be involved in the pathogenesis [40].

Impairment of the immune tolerance is very important in SLE development and severity. In this context, T cells have a major role [38].

Disturbances in regulatory T cell functions and some immunological abnormalities are among some of the pathological features of SLE. There is a relationship between SLE disease and dysfunctions in helper T cells [38,40].

It has been found that there is a decrease in TGF-β cytokine and an increase in IL-10 cytokine in individuals with SLE disease [41].

Some autoantibodies can also be identified in SLE patients [33].

3.4. Some Treatment Approaches in SLE

Treatment of SLE may differ depending on different factors such as the course of the disease and its severity. In this context, the drug classes used vary depending on the severity of the disease. However, some suggestions are given for individuals with lupus in general. These recommendations are; not smoking, applying the necessary nutrition program and protection from the sunlight. In addition, performing adequate and regular exercises, and providing protection against ultraviolet light are among some of the conditions that should be considered in this context [31,33,39].

3.4.1. Treatment with Antimalarial Agents in SLE

Some antimalarial agents have been useful in patients with SLE who have fatigue, fever and musculoskeletal symptoms. These anti-malarial agents suppress the symptoms associated with SLE [33,40].

Hydroxychloroquine can be used as part of this treatment. The hydroxychloroquine agent is known to be beneficial for arthritis and skin symptoms, it reduces the inflammation in those areas [32,33].

3.4.2. Glucocorticoid Treatment in SLE

Glucocorticoid therapy may be preferred to decrease the disturbing symptoms of the lupus disease. Glucocorticoid therapy can be applied at the different doses depending on the course of the disease [31,40].

3.4.3. Treatment with Immunosuppressive Agents in SLE

Depending on the course of the disease, immunosuppressive agents can be used within the scope of the treatment for the disease. Cyclophosphamide is among the immunosuppressive agents that have been mostly used in SLE patients [31,33].

4. Conclusion

Autoimmune disorders lead to the symptoms that reduce the patients' quality of life. Although treatment approaches for the autoimmune diseases have progressed significantly and positively, especially in recent years, these treatment approaches are generally applied to increase the quality of life of the patient and to reduce the symptoms seen in the course of the disease rather than enabling a total cure for the disease. Novel biocompatible drug candidates should be generated by the biotechnological tools to eliminate the main reasons behind the development of the disease rather than just focusing on the elimination of the symptoms [42]. Future studies should focus on the disease development mechanisms for different autoimmune disorders and how to interfere at each point of the progress in order to develop better treatment approaches.

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Author contributions

Ceren Canatar: Conceptualized, wrote, reviewed. **Furkan Ayaz:** Edited the final version

Conflicts of interest

The authors declare no conflicts of interest.

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