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Is there a link between androgenetic alopecia and COVID-19?

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Abstract

Introduction and purpose: 20% of COVID-19 cases require hospitalization, with men most often being affected. Current studies indicate a relationship between the incidence and severity of the disease and androgens, including a worse prognosis in patients with androgenetic alopecia. The aim of the study is to analyze the available literature in the Pubmed and Google scholar database in order to find an answer to the question of whether there is a cause-and-effect relationship between androgenetic alopecia and COVID-19.

State of knowledge: Male sex hormones, androgen receptors, the presence of substances inducing the development of the inflammatory process and genetic factors are important in the

pathogenesis of androgenetic alopecia. It has been noted that androgens are involved in the entry of SARS-CoV-2 into cells and the reduction of the inflammatory response of the body that contribute to the development of the disease. On the one hand, patients hospitalized due to SARS-CoV-2 infection have low levels of male sex hormones, and on the other hand, diseases associated with increased levels of androgens, such as androgenetic alopecia or prostate cancer, are associated with more frequent incidence.
Summary: The relationship of androgens to the development of COVID-19 is not clear. Therefore, the relationship of this disease with androgenetic alopecia cannot be directly explained and there is a need for further research.

Key words: COVID-19, SARS-CoV-2, androgenic alopecia, antiandrogen drugs

1. Introduction and purpose

COVID-19 continues to be a serious problem worldwide, both epidemiologically, economically and socially. Epidemiological reports indicate that the severe course of the disease leads to hospitalization in 20% of cases, including 10% fatal in people with other burdens [2]. Moreover, more frequent hospitalizations and a more severe course of the disease were noticed in men than in women or children, similar to that observed in the Middle East respiratory syndrome epidemic [2, 4]. Therefore, a number of studies are currently underway to find the cause of this phenomenon. The significant factors influencing the occurrence of differences between sexes and age include, among others, socioeconomic conditions, immunological and genetic predisposition, coexistence of cardiovascular diseases as well as habits such as smoking or excessive alcohol consumption [10]. However, there is more and more talk about another significant factor that may be key to explain this phenomenon, and it is the relationship between COVID-19 and androgens [15]. However, the relationship is not entirely clear due to the varying results of many studies. In some of them it is emphasized that a high level of androgens affects the aforementioned more severe course and more frequent hospitalizations of patients, and in others their positive effect on the immune system is indicated [10]. In addition, during the research, a relationship between the disease caused by

the SARS-CoV-2 virus and the occurrence of another disease in which androgens play a significant role in the pathogenesis was noticed, and which affects approximately 50% of men before the age of 50 and over 70% after the age of 70 - androgenic alopecia [3, 10]. It has been noted that this disease is often comorbid in men with COVID-19 and is a risk factor for the severe course of the disease [9]. The aim of the study is to try to answer the question whether there is a relationship between androgenic alopecia and COVID-19. For this purpose, the available literature was analyzed in the Pubmed and Google scholar databases.

2. Androgenetic alopecia

Androgenetic alopecia is one of the most common causes of hair loss in both men and women, affecting approx. 2% of the entire world population [5]. The pathogenesis of the disease is multifactorial, and one of the main observed disorders is the miniaturization of the hair follicles [3]. Male sex hormones, androgen receptors, the presence of substances inducing the development of the inflammatory process, and genetic factors play a significant role [1]. The first of them - androgens affect both hair growth and loss. Among them, the key role is played by dihydrotestosterone, which is formed during the transformation of testosterone thanks to the enzyme 5-alpha-reductase, which occurs in two isoforms. This is 2 5-alpha-eductase that occurs in the prostate gland, vas deferens, seminal vesicles, epididymides and hair follicles is of the greatest importance for the development of the disease. As for androgen receptors - their greatest concentration is found on the scalp, and there are more of them in people suffering from androgenetic alopecia [1]. The characteristic feature is hair loss without scarring. The morphology of these changes depends on the type - male (MPB) or female (FPHL). In the former, the frontal hairline recedes, and in the latter, diffuse and central thinning [7]. The remaining changes concern changes in the thickness and length of the hair, they become shorter and thinner, but also may concern the psychological sphere, due to the fact that the condition of the hair is related to the external appearance, which shape the feeling of attractiveness by humans [13]. In the diagnosis of the disease, it is crucial to collect a detailed clinical history and supplement it with a trichoscopic examination using a dermoscope or videodermoscope [3]. In order to make an accurate diagnosis, other disease entities should be taken into account, such as: telogen effluvium, involutional alopecia, perifollicular lichen, alopecia areata or scarring alopecia [3]. The treatment includes medications, monotherapy and polytherapy, specialist care treatments, as well as dietary supplements and natural remedies. The drugs used include: minoxidil (works by opening

potassium channels and stimulating angiogenesis and vasodilation of blood vessels), finasteride (as a selective inhibitor of the type 2 isoenzyme 5alpha-reductase reduces the conversion of testosterone to dihydrotestosterone, reduces the risk of developing prostate cancer, and its side effects include sexual and mood disorders [8]. Representatives of natural remedies and dietary supplements are: saw palmetto (similar to finasteride, but without similar side effects), green tea (contains antioxidants, has anti-inflammatory effects), pumpkin seeds, grape, licorice and rosemary [6]. The key to the effectiveness of the therapy is the early diagnosis and implementation of the treatment, which is difficult and long-lasting. green tea (contains antioxidants, has anti-inflammatory properties), pumpkin seeds, grape, licorice and rosemary [6]. The key to the effectiveness of the therapy is the early diagnosis and implementation of the treatment, which is difficult and long-lasting. green tea (contains antioxidants, has anti-inflammatory properties), pumpkin seeds, grape, licorice and rosemary [6]. The key to the effectiveness of the therapy is the early diagnosis and implementation of the treatment, which is difficult and long-lasting.

3. The effect of androgens on COVID-19

After observing that there was a significant disproportion in the incidence of COVID-19 among men and women, people began to wonder what the cause of this was. This phenomenon is based on changes related to the level and sensitivity of androgens, and the occurrence of androgen receptor variants [9]. On the one hand, research by scientists from Germany shows that in most patients staying in intensive care units the level of androgens is low and correlates with a worse prognosis for the course of the disease [12, 14]. At the same time, the level of androgens decreases with age and with the coexistence of such diseases as obesity, diabetes, and cardiovascular diseases, which are factors of increased risk of COVID-19 [11]. On the other hand, in patients with diseases dependent on various variants of androgen receptors and elevated levels of dihydrotestosterone, such as androgenic alopecia and prostate cancer, an increased incidence of COVID-19 was observed [9]. Moreover, people with prostate cancer who commonly use ADT (Androgen deprivation therapy) have a lower risk of infection than those who do not use it [9]. Research shows that androgens are involved in the facilitation of SARS-CoV-2 penetration into the cell and at the same time reduce the inflammatory response of the body. Transmembrane protease serine 2 (TMPRSS2) plays an important role in the penetration of the virus into the cell, which occurs mainly in the lungs, liver and kidneys, which are organs characteristic of COVID-19 occupation [10]. Androgens

act as promoters for these proteins. Viral spike proteins use Transmembrane protease serine 2 (TMPRSS2) to enter cells, but they can also attach to Angiotensin-converting enzyme 2 (ACE2) receptors, which are a renin-angiotensin system modulator, are important in protecting cells from damage such as hypertension, cardiovascular disease, and acute respiratory distress syndrome (ARDS). Moreover, it is worth noting that androgen receptors have three functional domains, the N-terminal transactivation domain harbors and the polymorphic CAG nucleotide repeat segment [9]. As a result, short CAG repeats result in a higher expression of androgen receptors, a higher promotion of TMPRSS2 transcription and a higher risk of developing a more severe form of the disease. In contrast, longer repeats result in lower expression and less functionality of androgen receptors and ultimately lower risk of developing the disease. In addition, drugs proposed for the treatment of COVID-19, including: hydro hydroxychloroquine, Nitric oxide (NO) and dexamethasone reduce the secretion of androgens and thus reduce the course of the disease [9]. Drugs used in the treatment of diseases such as androgenic alopecia, including; finasteride, dutasteride, or spironolactone [10].

4. Summary

As shown by the studies conducted so far, sex hormones, especially androgens, do not have a clear role in the development of COVID-19, inhibition or intensification of disease progression. Various studies indicate that the levels of these hormones and androgen receptor variants contribute differently to the development of the disease. In patients with increased levels of these hormones, such as androgenetic alopecia, the incidence of COVID-19 may be higher and may be associated with a more severe course of the disease. Therefore, there is a need for further research to explain the relationship between androgens, androgenetic alopecia and SARS-CoV-2 virus infection.

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