

Autoimmunity and gender: Understanding the sex bias in autoimmune diseases.

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Introduction

Autoimmune diseases are a group of disorders characterized by an abnormal immune response, where the immune system mistakenly attacks the body's own tissues and organs. These diseases can affect various systems in the body, including the skin, joints, thyroid, and kidneys, among others. Interestingly, autoimmune diseases display a striking sex bias, with a significantly higher prevalence in women compared to men. This article aims to explore the relationship between autoimmunity and gender, examining the potential factors contributing to this sex bias and the implications it has on disease manifestation and management [1].

Numerous autoimmune diseases exhibit a higher prevalence in women, including rheumatoid arthritis, systemic lupus erythematosus, multiple sclerosis, and Sjogren syndrome, to name a few. The female-to-male ratio in these diseases can range from 3:1 to 9:1. This gender bias suggests that sex-specific factors, both biological and non-biological, play a role in the development and progression of autoimmune diseases. Sex hormones, particularly estrogen and progesterone, are thought to contribute to the gender disparity observed in autoimmune diseases. Estrogen, in particular, has been implicated in modulating the immune response by influencing the production and activity of immune cells, cytokines, and antibodies. It is believed that estrogen promotes an enhanced immune response, which may contribute to the increased susceptibility of women to autoimmune diseases. Furthermore, fluctuations in hormone levels during puberty, pregnancy, and menopause can influence disease onset, severity, and progression [2].

Genetic predisposition is another important factor in the development of autoimmune diseases. Specific gene variants have been associated with increased susceptibility to various autoimmune conditions. Interestingly, many of these susceptibility genes are located on the X chromosome. Since women have two copies of the X chromosome, it is theorized that they may be more susceptible to autoimmune diseases due to the presence of these genetic risk factors. Furthermore, genes involved in immune regulation and self-tolerance may be differentially expressed between males and females, contributing to differences in immune responses and disease susceptibility [3].

Epigenetic modifications, which involve alterations in gene

expression without changes in the underlying DNA sequence, have emerged as potential mediators of the gender bias in autoimmune diseases. These modifications can be influenced by various factors, including hormones, environmental exposures, and lifestyle choices. Epigenetic changes can impact immune cell function, cytokine production, and immune tolerance, potentially leading to an increased risk of autoimmunity in susceptible individuals. Environmental factors play a significant role in the development of autoimmune diseases. It is believed that certain triggers, such as infections, hormonal changes, stress, and exposure to certain chemicals or drugs, may interact with genetic and hormonal factors to initiate or exacerbate autoimmune responses. The impact of these triggers may differ between men and women, further contributing to the gender disparity in autoimmune disease prevalence [4].

Sex-related differences in the immune response have been observed, and these differences may contribute to variations in disease susceptibility and progression. The innate and adaptive immune systems of males and females exhibit variations in cell types, cytokine profiles, and immune signaling pathways. These differences may result in contrasting immune responses and contribute to the increased prevalence of autoimmune diseases in women. The gender bias in autoimmune diseases has important implications for disease manifestation, diagnosis, and management. Women often experience different symptoms, disease progression patterns, and treatment responses compared to men. These differences can lead to delays in diagnosis, misdiagnosis [5].

Moving forward, further research is needed to unravel the precise mechanisms underlying the gender bias in autoimmunity. Longitudinal studies examining the impact of hormonal fluctuations, genetic predisposition, epigenetic modifications, and environmental factors on immune function and disease development will provide valuable insights. Additionally, the inclusion of sex as a biological variable in research studies and clinical trials is crucial for understanding the unique aspects of autoimmunity in both men and women.

Conclusion

The relationship between autoimmunity and gender is a complex and intriguing topic that continues to be studied extensively. The striking sex bias observed in autoimmune

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diseases, with a higher prevalence in women, highlights the influence of sex-specific factors in disease susceptibility, manifestation, and progression. Understanding the interplay between biological and non-biological factors can provide valuable insights into the underlying mechanisms and guide the development of more personalized approaches to diagnosis and treatment.

Hormonal influences, particularly oestrogen, play a significant role in modulating the immune response and may contribute to the increased prevalence of autoimmune diseases in women. Fluctuations in hormone levels during different life stages, such as puberty, pregnancy, and menopause, can impact disease onset and severity. Genetic factors, including X chromosome-linked susceptibility genes, also contribute to the gender bias, indicating a potential genetic predisposition for autoimmunity in women.

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