The Role of Viruses in the Initiation of Autoimmunity

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Abstract

In the current study, a literature search was carried out to investigate the possible function that viruses play in autoimmune illnesses. In this investigation, we were able to demonstrate that autoimmune illnesses are not only significant clinical conditions but also that their prevalence is growing over the course of time. The idea that viruses may play a role in the beginning stages of autoimmune disorders presents an interesting research question with important diagnostic and therapeutic ramifications.

Keywords: Viruses; Autoimmunity; Diabetes Type 1; Diagnosis; Therapeutic Implications

Introduction

Microbes are an important part, which could play a role in the development of autoimmune illnesses, and the immune responses that these microbes provoke can be divided into two categories: innate and adaptive [1]. The immune response can be presented as type 1 phenotype in the case of encountering intracellular pathogens such as viruses, or type 2 phenotype (allergic) in the case of encountering extracellular parasites such as helminthes [2,3]. This varies depending on the type of microbe that is being removed [2,3].

According to the information provided in this context, viruses are regarded to be the primary elements involved in the onset of autoimmune reactions, which are mostly defined by type 1 immune responses. Researchers from Manfredo and colleagues demonstrated that the translocation of the gut microbes *Enterococcus gallinarum* to the liver activated autoimmune responses in genetically modified mice, causing the development of systemic lupus erythematosus (SLE) in the mice [4]. This was accomplished by stimulating the production of multiple mediators, including cytokines, autoantigens, and endogenous retrovirus proteins. According to Ercolini and Miller, it is possible that the diagnosis of an autoimmune disease requires the presence of more than one pathogen [5]. This is something that should be mentioned. According to research done by Maizels et al., having an infection caused by helminthes is likely to provide some degree of protection from immunological reactions [6]. In addition, according to Manfredo researchers believe that helminthes have direct effects on the immunological processes that occur in response to auto antigens in autoimmune disorders [4].

The development of autoimmune responses has been attempted to be explained using a variety of different processes, which researchers have proposed. The entrance of intracellular pathogens like viruses is one of the primary methods that are regulated by the cellular immunity. According to Paul et al., viruses are responsible

for the destruction of infected cells as well as a rise in the production of MHC molecules on the membranes of infected cells [7]. This is in addition to the effective function of antigen-presenting cells (APC). According to the information provided by this context, host epitopes are likely to be given in a fashion that activates self-T cells [8]. According to the second mechanism that has been hypothesized, infection-causing pathogens are responsible for activating the general host defence mechanisms, which then eradicate the invading germs [9]. Inflammatory mechanisms are triggered as a direct consequence of this, and they include an increase in the synthesis of prostaglandins, cytokines, and chemokines, as well as the activation of both the innate immune system and the adaptive immune system [10]. Other inflammatory mediators are believed to play a role in the development of autoimmune reactions, which is based on the fact that the adaptive immune system preferentially target infections [11].

According to Kaer, the third method involves the activation of T cells by interacting with superantigens [12]. These superantigens are able to bind MHC and TCR in an independent manner, which ultimately results in reactions against self-components. The fourth mechanism is based on the fact that viruses and hosts have some structural components, which results in specific immune reactions that are likely to interact with host structures. This process is called structural similarity. This could be detrimental to the concept of self-tolerance, according to research by Cusick, et al. and Christen (Figure 1) [13,14].

Figure 1 (I-III): The role of viruses in the induction of autoimmunity [1].
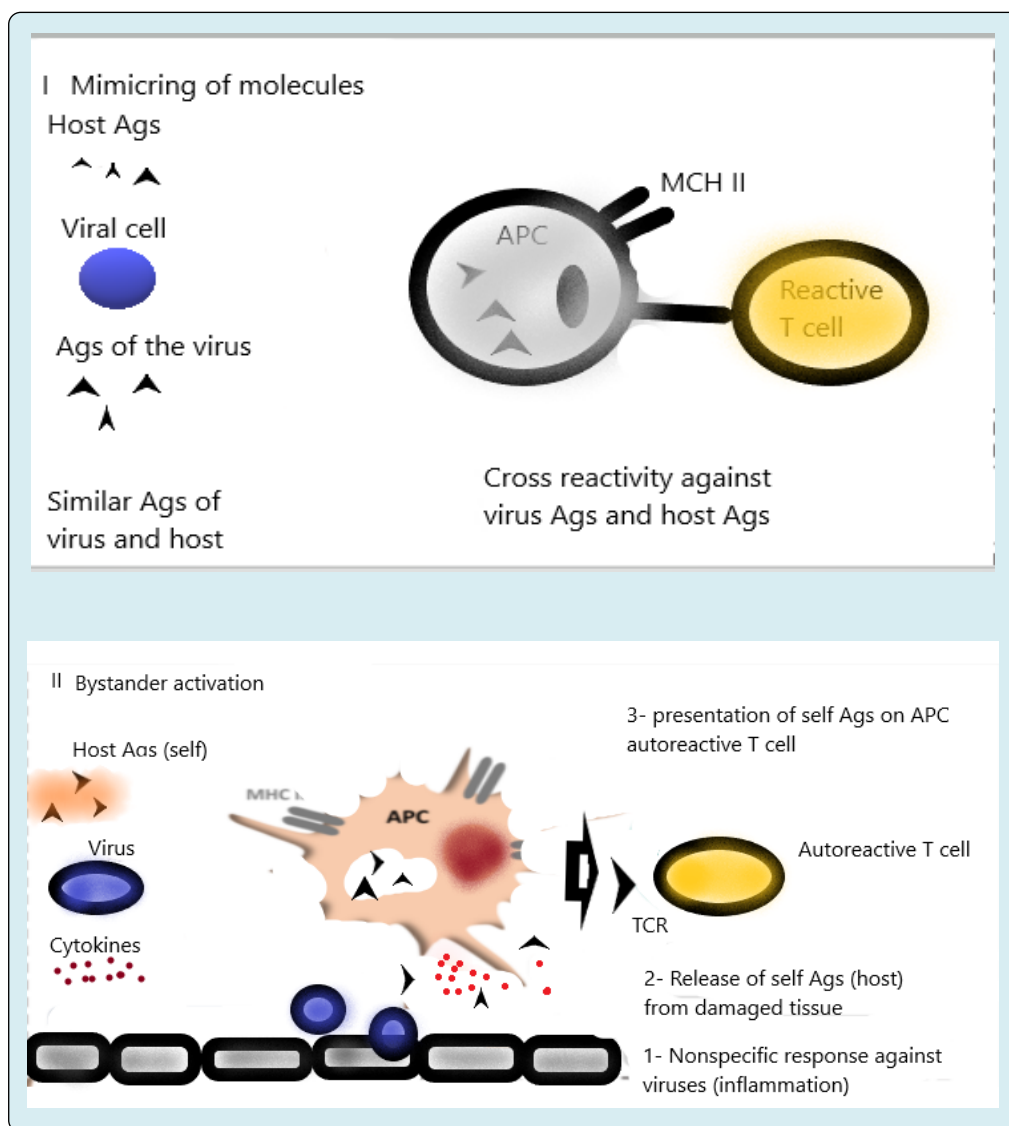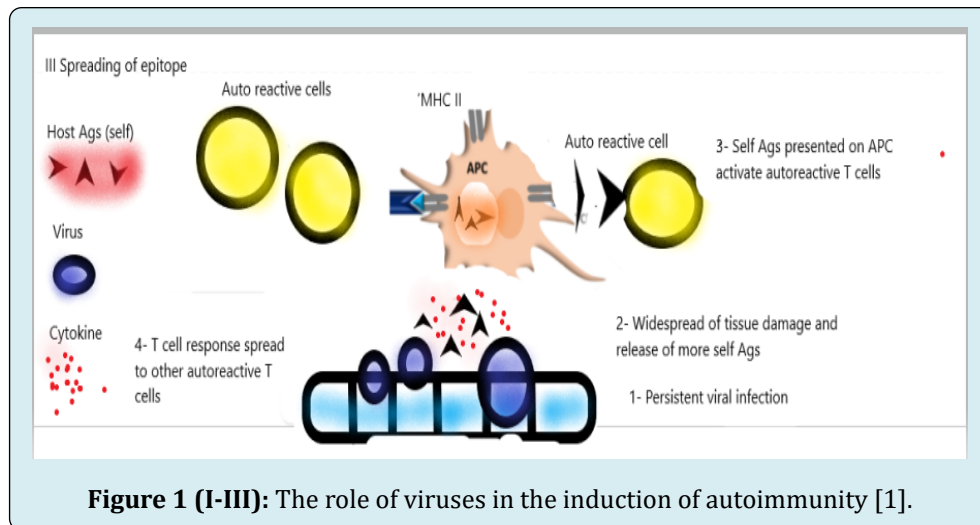
Gender Related Variations in the Induction of Autoimmunity and Viral Role

Xenobiotic exposure, neurodevelopmental and neurodegenerative diseases, and vaccine results are among the many complicated characteristics or diseases that demonstrate a difference in vulnerability between men and women [1]. Other examples include viral and autoimmune disorders. In most cases, the immune system of a female will react more quickly and efficiently to viruses. On the other hand, this could result in overly reactive immune responses, which may help to explain why girls are more likely than males to acquire autoimmune illnesses and why females may be more susceptible to the adverse effects of vaccinations than males. Other mechanisms, such as cellular mosaicism, skewed X chromosome inactivation, genes that escape X chromosome inactivation, and miRNAs, which genes are located in the X chromosome, have been proposed despite the fact that sex hormone effects have been the primary focus of the majority of research on gender differences in immunological responses [15].

Infections caused by viruses have been hypothesized [16,17]. These viruses include enteroviruses and human herpesviruses. However, according to the 'hygiene theory', research (mainly in animals) has shown that certain viral infections may suppress the development of type 1 diabetes [18-20]. This was discovered by the 'hygiene theory' [18]. According to Beck et al.'s research, the use of exogenous insulin's remains the primary therapeutic choice for people who have type 1 diabetes. Since the discovery of insulin in 1921, numerous innovative formulations, analogues, and delivery vehicles have been developed [21]. These advancements have made possible the treatment of a wider range.

Conclusion

Viruses play roles in initiating autoimmunity disorders, and participate in the development of diabetes type 1. The pathological role of viruses through mediating of immunological reactions should be taken in clinical implications in terms of diagnosis and designing new therapeutic options.

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