The Use of Adeno-associated virus (AAV) in Vaccine Development

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Abstract

Adeno-associated virus (AAV) is a very tiny (20-26 nm) icosahedral and non-enveloped virus, and it belongs to the Parvoviridae family. AAV vectors are the most widely used option for gene therapy and delivery of therapeutic antibodies due to their relatively low immunogenicity, high safety profile, broad tropism, and their tendency to maintain long-term gene expression [1]. AVV vectors are developed by transfection of human embryonic kidney (HEK) 293 T cells with transgene, packaging and helper plasmids [2]. Several clinical studies have investigated the use of AAV vectors for gene therapy in treating of Parkinson's disease, Alzheimer's disease, heart disease, and prostate cancer [3]. AAV vectors have previously been used to treat muscular diseases, but in recent years, their usage as vaccine vectors to cure or prevent infectious diseases including HIV, HPV, and influenza has expanded [4].

Here, we discuss the advantages and disadvantages of the use of AAV in vaccine development, and future approaches in improving the drawbacks caused by AAV-based vaccines. Numerous animal investigations have been conducted to explore vaccine vectors against various illnesses, suggesting a possibility for AAV-based vaccinations. Clinical studies on humans are, however, uncommon because, in contrast to other viral vectors, AAV induces a poor humoral and cellular immune response. Additionally, infectious vaccinations often target a large group of healthy individuals across a variety of ages, including children and teenagers. Therefore, compared to AAV-based gene therapies, vaccinations based on AAV vectors need to be more cost-effective and need more robust safety control.

According to several research, AAV vector vaccines have been shown to induce a stronger or longer lasting antibody response in comparison to other vaccination approaches, such as DNA, recombinant proteins, inactivated viruses, or virus-like particles (VLPs) [5]. However, AAV vectors are thought to have a low immunogenic profile in comparison to other viral vectors. The main limitations of AAV vectors are their low transgenic capacity and widespread pre-existing immunity in humans [6]. Currently, strategies for improving AAV immunogenicity and circumventing pre-existing immunity are actively being investigated. The research undertaken so far have highlighted numerous significant benefits of AAV vectors for immunisation. Despite all the advantages, there are still a variety of challenges that limit the use of these vectors as a vaccine in humans. Thus, it is necessary to overcome these challenges in order to make AAV-based vaccines effective.
Keywords
Adeno-associated virus, Vaccine development, Vector-based vaccine

References


