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FORMAL SYSTEMATIC REVIEW

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Nanoparticles in influenza subunit vaccine development: Immunogenicity enhancement

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Abstract

The threat of novel influenza infections has sparked research efforts to develop subunit vaccines that can induce a more broadly protective immunity by targeting selected regions of the virus. In general, subunit vaccines are safer but may be less immunogenic than whole cell inactivated or live attenuated vaccines. Hence, novel adjuvants that boost immunogenicity are increasingly needed as we move toward the era of modern vaccines. In addition, targeting, delivery, and display of the selected antigens on the surface of professional antigen-presenting cells are also important in vaccine design and development. The use of nanosized particles can be one of the strategies to enhance immunogenicity as they can be efficiently recognized by antigen-presenting cells. They can act as both immunopotentiators and delivery system for the selected antigens. This review will discuss on the applications, advantages, limitations, and types of nanoparticles (NPs) used in the preparation of influenza subunit vaccine candidates to enhance humoral and cellular immune responses.

KEYWORDS
immunogenicity, influenza vaccine, nanoparticles, subunit vaccine, vaccine delivery

1 | INTRODUCTION

Influenza virus infection is a global public health problem, causing a huge morbidity and mortality burden due to annual epidemics and pandemics. Worldwide, annual epidemics cause 3 to 5 million cases of severe illness, and about 290,000 to 650,000 deaths.[1] Vaccination is the most effective method to prevent influenza infection. Current influenza vaccines mainly rely on hemagglutinin (HA) proteins as antigens to induce neutralizing antibodies that can inhibit virus infection and replication in humans. These antibodies are mostly targeting the immunodominant epitopes of the influenza virus that are highly variable between different virus strains. Each year, new variants of influenza virus may emerge due to antigenic drift, which necessitates the reformulation of influenza vaccines on a yearly basis.[2] Previously, mismatches between predicted and actual circulating strain have resulted in reduced vaccine protection and increased clinical cases.[3] A "universal" vaccine that targets the conserved regions of influenza viruses and induces a broadly protective immunity may dramatically improve protection against seasonal and pandemic influenza viruses. Antibodies that target conserved sites in the HA stalk have been isolated from humans and shown to confer protection in animals challenged with various influenza virus strains and subtypes.[4] However, it is noteworthy that antibodies specifically targeting the conserved HA2 region can also increase disease severity by enhancing viral fusion to target cells, hence should be given sufficient consideration during universal vaccine design and evaluation.[5]

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