Recent advances in the vaccine development against Middle East respiratory syndrome-coronavirus

ABSTRACT

Middle East respiratory syndrome (MERS) is a deadly viral respiratory disease caused by MERS- coronavirus (MERS-CoV) infection. To date, there is no specific treatment proven effective against this viral disease. In addition, no vaccine has been licensed to prevent MERS-CoV infection thus far. Therefore, our current review focuses on the most recent studies in search of an effective MERS vaccine. Overall, vaccine candidates against MERS-CoV are mainly based upon the viral spike (S) protein, due to its vital role in the viral infectivity, although several studies focused on other viral proteins such as the nucleocapsid (N) protein, envelope (E) protein, and non-structural protein 16 (NSP16) have also been reported. In general, the potential vaccine candidates can be classified into six types: viral vector-based vaccine, DNA vaccine, subunit vaccine, nanoparticle-based vaccine, inactivated-whole virus vaccine and live-attenuated vaccine, which are discussed in detail. Besides, the immune responses and potential antibody dependent enhancement of MERS-CoV infection are extensively reviewed. In addition, animal models used to study MERS-CoV and evaluate the vaccine candidates are discussed intensively.